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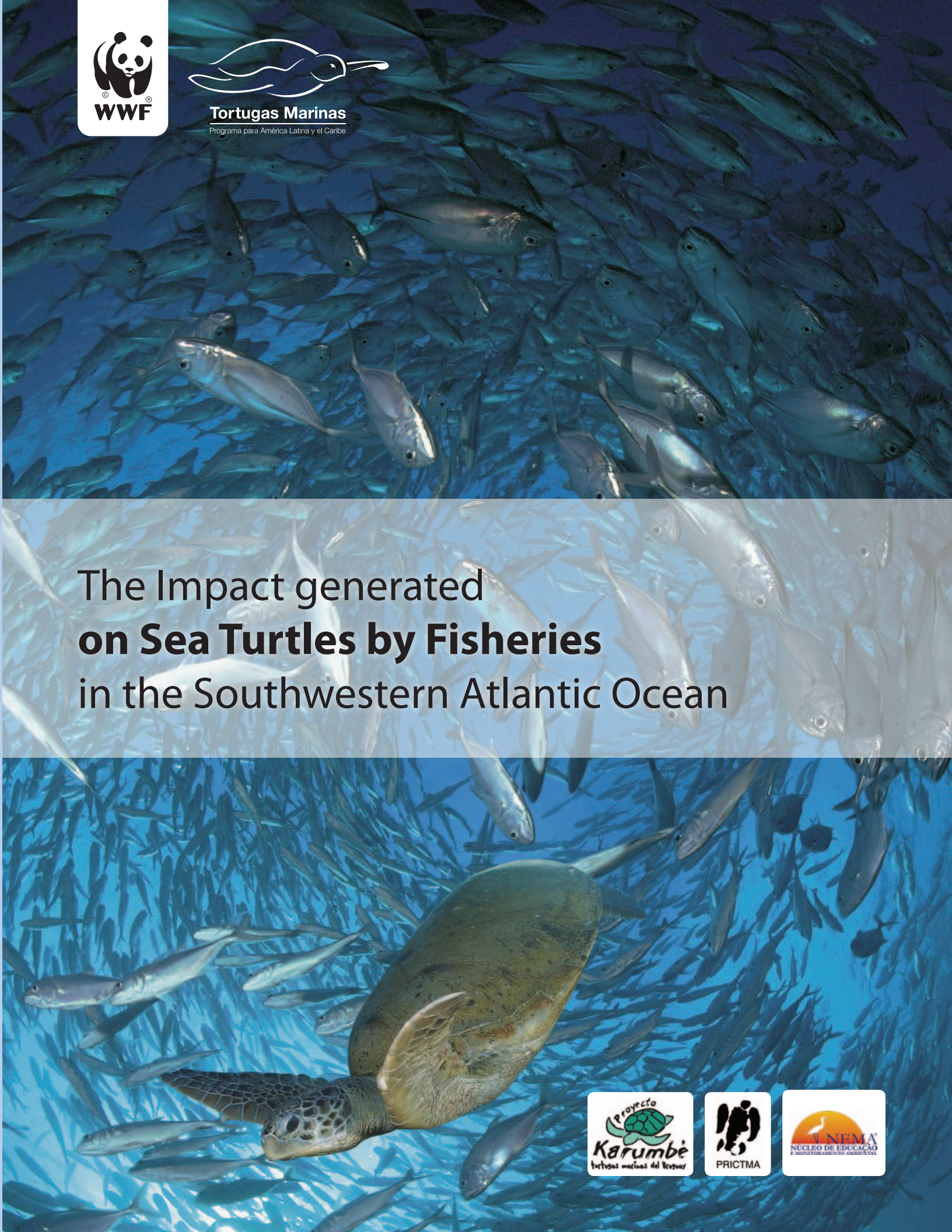
Programa para América Latina y el Caribe

# The Impact generated **on Sea Turtles by Fisheries** in the Southwestern Atlantic Ocean



Proyecto Karumbé tortugas marinas del Uruguay

PRICTMA

NEMA NÚCLEO DE EDUCAÇÃO E MONITORAMENTO AMBIENTAL

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# The Impact generated **on Sea Turtles by Fisheries** in the Southwestern Atlantic Ocean


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# Contents

# Summary

This document, which is directed at the fishing sector, researchers, conservationists and fishery administrators, was developed by researchers who are members of the Specialists Group for Marine Turtle Research and Conservation in the Southwestern Atlantic Ocean (SWA) in response to the urgent need to evaluate the impact generated on sea turtles by fisheries. Historically, sea turtle conservation efforts have focused almost exclusively on the protection of nesting beaches. Nevertheless, over the last decade, research has proved incidental mortality as a result of fishing activities to be one of the greatest threats to these animals. This type of interaction is not only problematic for turtles, but also generates financial losses for fishermen and businesses.

In spite of the efforts that are currently underway, researchers still do not have a detailed understanding of the impact that bycatch produces on sea turtle populations in the SWA. We have a long way to go before its effects can be minimized. Further research is needed regarding the biology and ecology of the various turtle species as well as the effective application of mitigation measures.

The life cycles of sea turtles are long and complex. Turtles occupy various ecosystems (nesting beaches, coastal, neritic and oceanic zones, as well as pelagic and demersal areas) throughout their lifetimes, transcending various Exclusive Economic Zones and International Waters. The five species that inhabit the SWA region perform vast feeding and reproductive migrations, traveling through areas where many different fishing fleets operate. Therefore, sea turtles in the SWA interact with virtually all fisheries. These circumstances make it necessary to carry out biological, fishing related and conservation studies on a regional level.

The efficiency of the existing international and national legal instruments has yet to be determined, in terms of their effectiveness in protecting sea turtles. In some cases, legislation that is specifically related to the interaction between fisheries and turtles does exist, such as those laws requiring the mandatory use of turtle excluding devices (TEDs). There are also explicit bans on sea turtle capture. Nevertheless, none of these regulations prevent sea turtle bycatch. Although some regional legal instruments are needed, these and the existing

legislation will only be effective if they are accompanied by a broader range of permanent education and control measures, to achieve the commitment of all the parties involved.

The ecosystem approach is gaining popularity among fishery administration organizations. Research and conservation efforts should also be moving in that direction. A regional and international effort is required in order to compile information regarding the bycatch produced by the various types of fisheries and fleets operating in the area. The enormous increase in fishing pressure that these fleets are exerting in this area has not been accompanied by an increase in information regarding the bycatch of species that have no commercial value.

Pelagic longlining is one of the fishing methods, which must be most closely monitored, due to the high levels of bycatch that it produces, as well its ample distribution throughout the region, and the high level of fishing effort that it accounts for. Coastal trawlers and gillnetters must also be considered critical players, because they too produce a large rate of bycatch. These are the three types of fisheries that are most broadly distributed throughout the region, accounting for the majority of the fishing effort.

Most of the institutions that work toward sea turtle conservation in the area have only begun to address the issue of bycatch over the last decade. This timeframe is reflected in the scope and quantity of the available publications, as well as the progress of activities directed at mitigating this problem. All of the institutions that have been mentioned in this report have made the gathering of information regarding interaction between sea turtles and fisheries one of their top priorities. Some institutions are even developing working programs for monitoring fisheries and testing mitigation measures. Many of these institutions have managed to develop adequate relationships with fishermen, ship owners and administrators. Nevertheless, limited access to funding is an obstacle to the development and testing of mitigation measures.

The SWA network, which is a very valuable instrument that was created in 2003, has allowed the region's institutions and researchers to exchange information and share their experience, in addition to lending each other support in carrying out joint activities, thus strengthening sea turtle conservation efforts. The capacity demonstrated so far by the region's researchers and institutions, testifies to their ability to continue to make progress in knowledge generation and tests of bycatch mitigation measures.

# Glossary

**ARGOS**.....Satellite Telemetry service provider.

**CECLIMAR** .....Centro de Estudos Costeiros, Limnológicos e Marinhos.

**DNA** .....Deoxyribonucleic acid.

**IAC** .....Interamerican Convention for the Conservation of Sea Turtles.

**ICCAT** .....International Commission for the Conservation of Atlantic Tunas.

**IUCN** .....International Union for the Conservation of Nature.

**CITES** .....Convention on International Trade of Endangered Species of Wild Fauna and Flora.

**CMS** .....Convention on Migratory Species.

**CONAMA** .....Conselho Nacional do Meio Ambiente.

**CONVEMAR**.....Convenio de las Naciones Unidas sobre el Derecho del Mar (UNCLOS).

**COP**.....Conference of the Parties.

**CPUE**.....Capture Per Unit Effort.

**CRAM**.....Centro de Recuperação de Animais Marinhos.

**DINARA** .....Dirección Nacional de Recursos Acuáticos.

**EEZ** .....Economic Exclusive Zone.

**FAO**.....Food and Agriculture Organization of the United Nations.

**GEMARS** .....Grupo de Estudos de Mamiferos Aquáticos do Rio Grande do Sul.

**IBAMA** .....Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis.

**ICOM**.....International Council of Museums

**INIDEP** .....Instituto Nacional de Investigación y Desarrollo Pesquero.

**MOVI** .....Museu Oceanográfico do Vale do Itajaí.

**NEMA** .....Núcleo de Educação e Monitoramento Ambiental.

**PNOFA** .....Programa Nacional de Observadores a bordo de la Flota Atunera.

**PRICTMA** .....Programa Regional de Investigación y Conservación de Tortugas Marinas en Argentina.

**PROMACODA** .....Programa de Marcaja y Colecta de Datos Abordo.

**PROARTE**.....Programa de Monitoreo en la Pesca Artesanal.

**RAMSAR**.....The Ramsar Convention on Wetlands.

**SWA** .....South Western Atlantic Ocean .

**SUDEPE** .....Superintendência do Desenvolvimento da Pesca.

**TAMAR**.....Projeto Tartaruga Marinha.

**TED** .....Turtle Excluder Device.

**UFRGS** .....Universidade Federal do Rio Grande do Sul.

**UNIVALI** .....Universidade do Vale do Itajai.

**WCS** .....Wildlife Conservation Society.

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# Introduction

For over 30 years, conservation and research efforts regarding sea turtles have been directed almost exclusively at the protection of nesting beaches. In contrast, very little research has been conducted in the open ocean, where the majority of these animals' life cycle transpires. It is in that environment that sea turtles frequently interact with various types of fishing vessels, which gives rise to incidental capture with high a rate of mortality. This interaction causes problems not only for turtles, but it also generates financial losses for the fishermen and fisheries. This situation has motivated a series of actions in different regions around the globe, aimed at mitigating the negative effects that these interactions produce. One example is the use of Turtle Excluding Devices (TED) on some trawling boats, which has effectively reduced the bycatch of sea turtles, thus benefiting both turtle populations as well as fisheries.

Over the last few years, various agreements have been developed in order to promote international sea turtle conservation. Organizations such as the FAO, CMS and IUCN, among others, in addition to many researchers, have alerted the international community as to the status of sea turtle populations. The IUCN has classified the green turtle (*Chelonia mydas*), the loggerhead turtle (*Caretta caretta*) and the olive ridley (*Lepidochelys olivacea*) as Endangered and the leatherback turtle (*Dermochelys coriacea*) as well as the hawksbill turtle (*Eretmochelys imbricata*) as Critically Endangered.

Nevertheless, despite a high level of commitment on the part of the international community, in most countries, a detailed knowledge of the impact of incidental fishing on sea turtle populations does not yet exist. In addition, effective mitigation measures have not yet been implemented in many nations.

This document was created by a group of researchers who are members of the Specialists Group for Marine Turtle Research and Conservation in The Southwestern Atlantic Ocean (SWA) in response to the urgent need to evaluate this problem. This report is directed at all the actors (people and institutions) involved in this issue, including the fishing industry, researchers, conservationists and fisheries administrators. The information and conclusions that are provided in this report prepare those actors to make better decisions and implement adequate conservation measures for the protection of sea turtles.

# General Objective of the Document

To Compile and analyze the available information related to the interaction of sea turtles with fisheries operating in the Southwestern Atlantic (SWA). To establish recommendations and priority actions that will allow this issue to be addressed on a regional level, making the development of management policies directed at sea turtle conservation possible.

## Specific objectives

- Compiling and analyzing bibliographical precedents and available data.
- Providing a description of the biology and ecology of the species that are present in the region.
- Identifying the institutions that conduct research and conservation activities related to sea turtles and fisheries in the SWA.
- Analyzing the research projects in progress and conservation measures currently in effect.
- Evaluating the strengths and weaknesses of conservation efforts, research and management policies.
- Establishing short term, medium term and long term priority actions, making recommendations for mitigating the problem and determining what is needed in order to implement these actions.

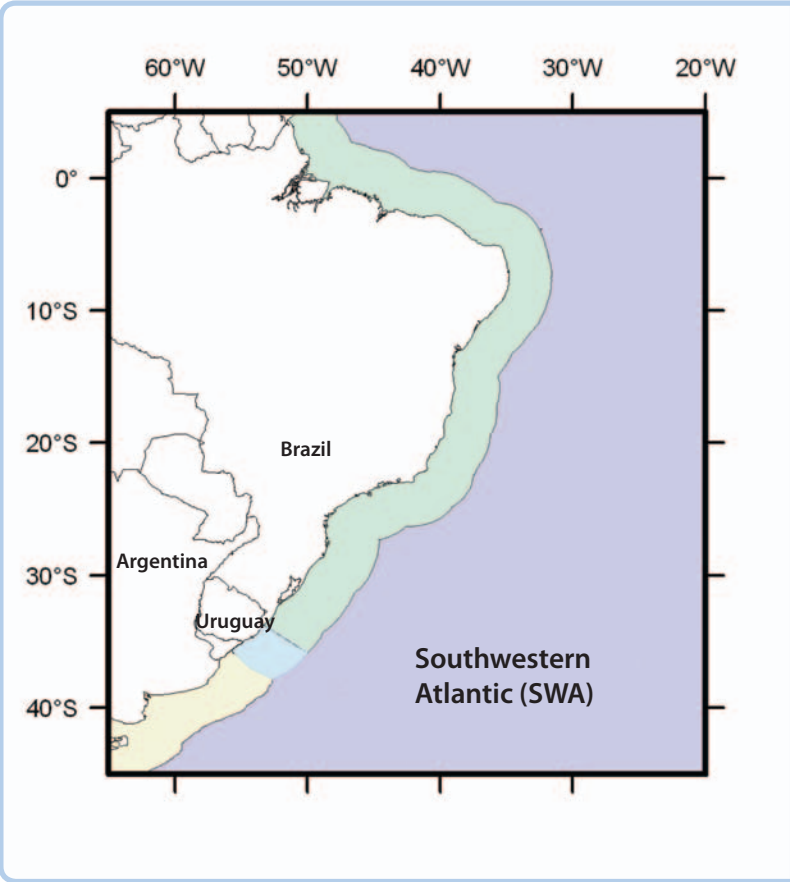
## Scope and Application of the Document

This document seeks to provide researchers, administrators and social organizations with a series of tools for research, management and the conservation of sea turtles in the SWA.

# Study Area

The area of study covered by this project consists of the Exclusive Economic Zones of Brazil, Uruguay and part of Argentina as well as the adjacent international waters of the Atlantic Ocean between 5ºN to 45º S and 20º to 65º W.

The northern and southern boundaries correspond, respectively, to the edge of the Brazilian EEZ, and to the most southerly data regarding the occurrence of sea turtles in the Southwestern Atlantic ocean, which were found during the bibliographic analysis. The eastern boundary corresponds to the line that divides the South Atlantic Ocean approximately in half, and the western boundary corresponds to the coast line.




**For the purposes of this study, that area is referred to as the Southwestern Atlantic (SWA).**

# Biological and Ecological Description of the Species

## *Caretta caretta*
## Loggerhead Turtle, Tortuga Cabezona, Tartaruga-Cabeçuda

This species is distributed globally and inhabits the continental shelves, as well as the bays, lagoons and estuaries of the temperate, subtropical and tropical regions of all the world's oceans (Dood 1988). It is found from northern Brazil (Bellini & Sanches 1998; Bruno Giffoni pers. com.) to the San Matías Gulf in Rio Negro, Argentina (40º45'S, 64º57'W) (Raúl González pers. com. Director of the "Almirante Storni" Institute of Marine and Fishery Biology , Argentina). The presence of this species in the Southwestern Atlantic has been reported for more than 80 years (Murphy 1914, Freiberg 1945) as a result of incidental fishing, strandings and egg laying events.

**IUCN, category (2002):** "Endangered" (EN A1 abd), due to a 50% reduction in the global population of this species over the last three generations (Hilton – Taylor 2000; IUCN 2004).

### Nesting Areas

The primary nesting beaches along the Atlantic coast of South America are located in Brazil. The state of Bahia was home to 54.8% (5212 nests), Espirito Santo 20.9% (1988 nests), Rio de Janeiro 18.7% (1781 nests) and Sergipe 5.6% (536 nests) of the total number of protected nests recorded over the last two seasons (2002/2003 and 2003/2004). The most southerly nesting was recorded in the state of Santa Catarina (Soto *et al.* 1997) and Rio Grande do Sul (Nakashima *et al.* 2004). The species has nesting intervals of two to three years. The size range of egg laying females for the Espirito Santo, Brazilian colony is between 83 to 123 cm Curved Carapace Length (CCL) (mean=102.7cm, for 198 individuals) (Baptistotte *et al.* 2003), which is similar to sizes recorded at Praia do Forte, Bahia (mean=102.8, number=76 individuals) (Marcovaldi & Laurent 1996).

### Juvenile Development Areas

Juveniles develop in pelagic areas. Following this oceanic stage, which can last a decade or longer, immature individuals begin to appear in neritic habitats near the continental coastline. Along the coast of Rio Grande do Sul, individuals between 63.0 and 97.0 cm (CCL) (mean=73 cm, n=16), (Bugoni *et al*. 2003) have been recorded. Sixty three immature individuals have been captured along that same coast during pelagic longline fishing, with a size range of 58.6 cm ± 6.8 cm, similar to data found by Kotas *et al*. (2004) who recorded animals captured by longliners in southern Brazil with a mean size of 58.0 cm (46 to 73 cm, n=54). Immature individuals in the later growth stages have been found in the Rio de La Plata estuary (Min=51 cm, Max=83 cm, mean=69.0 cm, n=124) (Lopez–Mendilaharsu *et al.* in press). For the Argentinean coast, the size range is between 57 and 88 cm, with an average of 71 cm (n=12) (Albareda *et al.* 2003).

### Population Genetics

Three characteristic haplotypes were identified on the nesting beaches of Bahia and Espirito Santo, Brazil, (A4, A24, and A25) (n=81) (Bowen *et al*. 1994; Encalada *et al.* 1998).

Another study indicated that six haplotypes were found for 42 samples taken from immature individuals in open sea areas, where the pelagic longline fleet operates

(Soares 2005). Four of these are known for nesting colonies that have already been distinguished: A4 (Brazil), A2 (North Atlantic), A11 (U.S. and Indian) and A34 (Pacific). 26% of these samples consisted of three new haplotypes, A33, A34, and A35 (n=9). Nevertheless, those individuals' beaches of origin remain unknown (Soares 2005). According to Soares (2005), the haplotypes described for this species in the South Atlantic nesting areas of Brazil and the different locations where incidental capture takes place are the following: CC-A1, CC-A2, CC-A3, CC-A4, CC-A5, CC-A6, CC-A7, CC-A8, CC-A9, CC-A10, CC-A12, CC-A13, CC-A14, CC-A15, CC-A16, CC-A17, CC-A18, CC-A19, CC-A20, CC-A21, CC-A22, CC-A23, CC-A24, CC-A25, CC-A33, CC-A34, CC-A35.

## Migrations

The adult females that were identified using metallic tags have exhibited limited local movements of only a few kilometers, in addition to large migrations from the nesting beaches (Espirito Santo, Bahia, Sergipe) to feeding areas on the Uruguayan coasts of the Atlantic Ocean and Rio de la Plata or outside the Southwestern Atlantic (SWA) area (Azores Islands, North Atlantic) (Almeida *et al.* 2000; Marcovaldi *et al.* 2000; Laporta & Lopez 2003). Satellite telemetry studies conducted by TAMAR-IBAMA during the years 2000 and 2001 indicated the dispersion of eight females after the nesting season. Follow-up demonstrated that the females' post-nesting movements were made close to shore in depths of up to 200 meters (Tamar-IBAMA Project 2005).

## Feeding Areas

The loggerhead turtle is carnivorous throughout its lifetime. During its first years it feeds on pelagic invertebrates, turning to benthic invertebrates and fish remains during later juvenile and adult stages (Bjorndal 1997). Four studies refer to this species' feeding habits in the southern portion of the area with observations regarding the diet of more than fifty individuals stranded on the coasts of Rio Grande do Sul and Uruguay (Gudynas 1980, Pinedo *et al.* 1998, Bugoni *et al.* 2003 and López-Mendilaharsu *et al.,* in press). This species feeds on a variety of large and medium sized gastropod mollusks, benthic crustaceans, fish and polychaetes. An important number of actinias were also detected, which are epibionts that live on a number of species of crustaceans and gastropods. In three cases the presence of jellyfish and cirripede crustaceans was detected, which seems to indicate that, even in coastal regions, the loggerhead turtle feeds on organisms found in the water column. On the other hand, along the Uruguayan coast of Rio de la Plata, mainly bony fish remains were found, indicating that this species possibly takes advantage of the fish discarded by commercial fisheries, a phenomenon which has also been observed in other parts of the world. The presence of the *Rapana venosa,* commonly known as the Rapa whelk, makes the loggerhead turtle the only confirmed predator of this gastropod invader of the waters of the Rio de la Plata (López-Mendilaharsu *et al.,* in press).

**The loggerhead turtle lives along continental shelves and in bays, lagoons and estuaries located in the temperate, subtropical and tropical areas of all the world's oceans (Dood 1988).**

## *Chelonia mydas*
## Green Turtle, Tortuga Verde, Tartaruga-verde

This species is widely distributed, from the tropics to temperate regions (Hirth 1997). In the Southwestern Atlantic, it is known to be present from 0º latitude to 42º15'S-64º04'W, Fondeadero Sarmiento, Valdez peninsula, Chubut- Argentina (Albareda *et al.* 2003). This species has been studied in the region since the beginning of the twentieth century, on Trindade Island (Ribeiro 1919).

**IUCN, classification (2002):** Species classified as "Endangered" (EN A1 abd) worldwide according to the World Conservation Union Red List category (Hilton-Taylor 2000; IUCN 2004).

### Nesting Areas

Nesting generally takes place on islands, although continental nesting may occur, with nesting intervals of three years (Hirth 1997). In the Atlantic the most important areas are Tortuguero, Costa Rica (an estimated 17,000-37,000 females per year), Aves Island, Venezuela (300-500 females per year - 1994 season), Galibi, Suriname (1800 females - 1995 season), Ascension Island, U.K. (an estimated 3700 females - 2001 season) Bijagos, Guinea Bissau (2500 females – 2000 season) and Bioko, Equatorial Guinea (500 females – 1998 season) (Godley *et al.* 2001; Seminoff 2002; Troëng & Rankin 2005). In the SWA area, nesting occurs on Trinidade Island, Espirito Santo (an estimated 3000 nests per year for the 1982-1995 seasons); Atol das Rocas, Rio Grande do Norte (RN) (551 nests, for the 1994 to 1996 seasons) (Bellini *et al.* 1996), and Fernando de Noronha, RN (58 females tagged in total with a total of 14 females in 1994). (Moreira *et al.* 1995; Bellini & Sánchez 1996; Bellini *et al.* 1996). The average size of the females for the Brazilian colonies is 116.8 cm with a range of between 101 and 143 cm CCL (Moreira *et al.* 1995).

### Juvenile Development Areas

Following the "lost years", in which youngsters inhabit pelagic zones, concentrations of juveniles (>30 cm CCL) are found in temperate and warm water coastal areas (Bjorndal 1997). In Brazil, along the coast of Paraiba, there are individuals with an average length of 56.0 cm CCL (n=56) and the island of Fernando de Noronha hosts individuals with an average length of 49.4 cm CCL (ranging from 32.5 to 60.0 cm, n=17) (Bellini & Sánchez 1996; Mascarenhas *et al.* 2005). In Ubatuba, Sao Paolo, there are individuals with CCLs between 27 and 96 cm (mean=40.6, n=2254) (Gallo *et al.* in press).

In Rio Grande do Sul, there are individuals between 29 and 68 cm CCL (mean=40.5 ± 5.9 cm, n=332), which are similar in size to juvenile individuals recorded along the Uruguayan coast with CCLs of 28.0 to 79.5 cm (mean=41.4 cm, n=429) (Monteiro 2004; López-Mendilaharsu *et al.* in press). For Argentina, the records show a smaller range of 32.2 to 51.0 cm CCL (average=39.9 cm) (Albareda *et al.* 2003).

### Population Genetics

The use of DNAmt in phylogeographical studies of Atlantic green turtles has produced successful results. It has also helped reveal their population structure, reproductive behavior, and migratory patterns Bowen *et al.* 1992).

Six haplotypes were found in twenty samples from Uruguay (CM5, CM6, CM8, CM9, CM10, CM24), nine haplotypes were identified in Ubatuba, São Paulo, (CM3, CM5, CM8, CM9, CM10, CM24, CM32, CM44, CM46) and, thirteen haplotypes for Almofala, in the state of Ceará (CM3, CM5, CM6, CM8, CM9, CM10, CM16, CM21, CM24, CM32, CM44, CM45, CM46) (Naro-Maciel *et al.* in press).

The most common haplotype is CM8, which was recorded in 62% of the samples taken from Uruguay, 72% of those taken from Ubatuba, Sao Paolo and 45% of those taken from Almofala, Ceará.

There is no clear subdivision between the samples from Ubatuba and Uruguay, which is not surprising given their geographical proximity, and because tagged specimens were recaptured in many cases. The minor differences found between Almofala and Uruguay were unexpected. The frequencies of alleles in individuals from the south are intermediate among Brazilian groups (Caraccio *et al.* in press).

## Migrations

The recaptures of tagged adult specimens are evidence of large migrations from nesting beaches to feeding areas, involving several Atlantic and Caribbean countries and territories. During the 1970's, tagged adults form the nesting colonies of Ascension Island and Suriname were recaptured in the coastal region of Almofala, Ceará and areas as far south as Rio de Janeiro, which shows that turtles use the coastal region as a feeding area (Carr 1975, Mortimer & Carr 1987). A female tagged in Tortuguero, Costa Rica was recently recaptured in Fortaleza, Ceará - Lima & Troëng 2001). Conversely, an adult female that had been tagged in Ceará was recaptured in Trinidad (Lum *et al.* 1998). In the South Atlantic, adult females tagged at the Trinidade Island colony have been found along the coasts of the states of Ceará, Espirito Santo, Bahia and Pernambuco in Brazil, and Senegal, in Africa (Marcovaldi *et al.* 2000). These observations show the interconnection between this species' main nesting colonies and its feeding areas, which are distributed throughout the entire South Atlantic Ocean and part of the Caribbean Sea.

Recapturing also helps reveal movements inside juvenile development areas and the different uses of various habitats. Some individuals tagged in Ceará have been recaptured in nearby areas after having made local movements, while others have traveled to the Caribbean sea (Trinidad & Tobago, Nicaragua and Costa Rica) (Lum *et al.* 1998, Lima *et al.* 1999, 2003, Lima & Troëng 2001). In the southern portion of the region, juvenile individuals tagged at Ubatuba, São Paolo (2071 individuals tagged, 151 recaptured for the period between 1991-1998) have been found along much of the Brazilian coast (Bahia, Espirito Santo, Rio de Janeiro, São Paulo, Santa Catarina, Rio Grande do Sul) and the Uruguayan coast (López-Mendilaharsu *et al.* in press). Most of these movements are short (< less than 180 days) and local (<100 km), however, some individuals have been recaptured in distant locations such as Mucuri, Bahia (900 km to the north) or Piriapolis, Uruguay (1400 km to the south) (Gallo *et al.* in press; López-Mendilaharsu *et al.* in press). Conversely, turtles tagged at Rocha, Uruguay have been recaptured in Santa Catarina, Brazil. (López-Mendilaharsu *et al.* in press). Local movements of tagged turtles have been recorded in Argentina (Albareda *et al.* 2003) and at Lagoa dos Patos, in southern Brazil (NEMA-Environmental Monitoring and Education Center, unpublished data).

Eight juvenile and adult individuals (ranging from 41 to 116 cm CCL) were recently monitored using satellite telemetry in Ceará. During that study, three behavioral patterns were identified: residence with a high level of fidelity to one location, short range movements (<100 km) and long range movements (>100 km) (Godley *et al.* 2003). This confirms the findings of a host of similar studies where turtles that were monitored were found to use coastal waters as feeding areas, showing a great deal of fidelity to one location.

**Green sea turtle nesting generally takes place on islands, although the species may also lay its eggs at continental locations, with nesting intervals of three years (Hirth 1997).**

### Feeding Areas

Several dietary studies have been conducted on individuals captured in the development areas (Ferreira 1968; Sazima & Sazima 1983; Pinedo *et al.* 1998; Bugoni *et al.* 2003; Calvo *et al.* 2003; López-Mendilaharsu in press). In Ceará, Ferreira (1968) reported 28 species of red algae, nine species of green algae, and six species brown algae in the stomach contents of 94 immature and adult specimens with shell lengths ranging between 31 and 120 centimeters. In São Paolo, Sazima & Sazima (1983) recorded seven species of red algae, four species of green algae and two species of brown algae in the stomach contents of four immature specimens. Green algae, tunicates, bony fish and mollusk shells were found in twenty four individuals stranded on the coast of Rio Grande do Sul in 1996 (Pinedo *et al.* 1998). During a recent study in 2003, after analyzing 38 stranded individuals Bugoni and collaborators found mollusks to be the main source of food (60% of the total diet). Smaller proportions of Green algae (*Ulva sp*. 36%), crustaceans (10% decapods, 3% isopods and 3% amphipods ) 10% jellyfish and 2.6% echinodermos, were also observed. Interestingly, a terrestrial grass species, *Luziola peruviana,* which is frequently found around the edges of lakes, along river banks and around saltwater lagoons, was also present. Along the Uruguayan shore of Rio de la Plata and the Atlantic coast, the diet of green turtles is composed mainly of algae. Fourteen species have been recorded in a total of 18 individuals that were analyzed (nine red, three green and two brown algae species) (Calvo *et al.* 2003; López-Mendilaharsu in press).

**The *Dermochelys coriacea*, or leatherback turtle, has been classified as critically endangered (IUCN, 2000).**

## *Dermochelys coriacea*
## Leatherback Turtle, Tortuga 7 quillas, Tartaruga-de-couro

The leatherback turtle has a large distribution range within the region, its presence having been reported in the area since 1928 (Frazier 1984). Immature individuals of the *D. coriacea* species with carapaces up to 1 meter long have been observed in warmer waters, while adults are also found in colder waters (Eckert 2002). This species has been observed in the San Blas Bay in the province of Buenos Aires, Argentina (40º 23´ S, 62º 26´ W). That is the southern distribution limit for the Southwestern Atlantic (Prosdocimi *et al*. 2004).

**IUCN, category (2002):** "Critically Endangered", due to a reduction of at least 80% of its global population over the last three generations (CR A1 abd) (Hilton-Taylor 2000; IUCN 2004).

### Nesting Areas

This species prefers steep, deep water nesting beaches. The migration of adults, from feeding to nesting areas, occurs in two to three year intervals. In the Western Atlantic the main nesting colonies are in French Guiana (7800 nests during the 1998 season) and Suriname (4000 nests during the 1999 season) (Eckert 2001). In the Eastern Atlantic the main nesting beaches are in Gabon and nearby areas with an estimated egg laying population of 5800 females per season (Fretey & Billes 2000). In the SWA region, Espirito Santo, Brazil is home to a small colony, which hosts an estimated 3 to 19 females per season (160 nests over the last two reproductive seasons-2002/2003 and 2003/2004) (Barata *et al.* 2004). Sporadic nesting has also been observed in the

Brazilian states of Bahia, Rio de Janeiro, Santa Catarina and Rio Grande do Sul (Soto *et al.* 1997; Barata & Fabiano 2001).

### Juvenile Development Areas

Juvenile development areas are found in tropical pelagic zones (Musick & Limpus 1997). In the SWA, the presence of juveniles and adults (with CCLs ranging from 116 to 170 cm, mean=136.3 cm, n=30) has been observed in south and southeastern Brazil. (Barata *et al.*2004). Adults and juveniles are frequently sighted in feeding areas located in temperate or cold waters. Juvenile and adult individuals with CCLs between 122 and 171 cm (n=25) have been reported in Uruguay (López-Mendilaharsu in press). In Argentina, there have only been reports of animals with a CCL range of between 105 and 156 cm (n=4), with a mean length of 125.5 cm (Albareda *et al.* 2003). In Rio Grande do Sul, stranded individuals were measuring between 95 and 180 cm (mean=136.7 cm ± 16.4 cm, n=78) were discovered (Monteiro 2004).

### Population Genetics

Genetic studies of nesting females in Brazil and individuals observed in the Southwestern Atlantic have not yet been conducted. The genetic structure of the nesting colony at Gabon, in Africa, also remains unknown. Studies conducted on the populations at Suriname and French Guiana revealed similarities to other Caribbean populations (Dutton *et al.* 1999).

### Migrations

Recaptures of four females tagged on the coasts of Gabon, in Africa, were recently reported along the coasts of the Southwestern Atlantic. The turtles were found in Rio de Janeiro (23.02°S, 43.93°W), along the northern coast of Sao Paolo (23.82°S, 45.38°W), in the Brazilian Exclusive Economic Zone (31.22°S, 49.53° W) and at San Clemente del Tuyú, Argentina (36.37ºS, 56.65ºW). The specimens were all females in the reproductive stage, which had been tagged with metal flipper tags on the nesting beaches of Gamba and Mayumba, in Gabon, between November of 2002 and December of 2003. The period between tagging and recapture varied from 14 to 31 months. Of the four incidents of recapture, three took place as a result of interaction with fishing gear (gillnets and longlines), while one of the animals was found stranded. Three of the females died and the fourth was set free. These findings are evidence of a connection between African nesting beaches and western areas of the Atlantic Ocean.

### Feeding Areas

Although some information regarding the dietary habits of the leatherback turtles does exist, observations related to its diet and ecology are quite scarce on a global level. This species feeds mainly on jellyfish and physalias, although amphipods, tunicates and fish have also been reported in smaller quantities. In Rio Grande do Sul, the presence of pelagic tunicates was reported for 3 out of 24 stranded leatherbacks (Pinedo *et al*. 1998). *Libinia spinosa*, the "spider crab" was also found in another leatherback, which was analyzed in southern Brazil (Bugoni *et al.* 2003). The only specific dietary report that exists for the Uruguayan coast refers to a specimen captured in waters close to Piriapolis in May of 1969. The presence of jellyfish belonging to the Discomedusae family was described along with that of young spider crabs, *Libinia spinosa*, which live inside these jellyfish and were possibly ingested incidentally (Gudynas 1980; Frazier *et al.* 1985).

## *Eretmochelys imbricata*
## Hawksbill Turtle, Tortuga Carey, Tartaruga-de-Pente

This species is distributed globally with populations centered around tropical reefs (Bjorndal 1997). Its distribution in the SWA area is known to extend from Ceará to São Paolo, Brazil (Marcovaldi & Laurent 1996). As an exception, juvenile individuals have been found in Southern Brazil, as far south as Rio Grande do Sul (Soto & Beheregaray 1997). There have been no confirmed sightings of this species in Uruguay or Argentina (Albareda *et al.* 2003; Frazier 1984).

**IUCN, category (2002):** Classified as "Critically Endangered", due to an 80% reduction in its worldwide population over the last 105 years (CR A1 abd) (Hilton-Taylor 2000; IUCN 2004).

## Nesting areas

This species nests on sandy, low and high energy beaches, which are always located within tropical latitudes. It's nesting intervals last a minimum of two years. Important nesting areas are located in the Caribbean Sea and the Gulf of Guinea (Meylan 1999; Fretey 2001). In Brazil, the main nesting area is located on the northern coast of Bahia, where 94.5% (n=1957 nests) of the total known nests have been concentrated over the last two seasons (2002/2003 and 2003/2004). There are also records of nesting on the coast of Rio Grande do Norte (Praia da Pipa), in addition to some sporadic nesting on the beaches of Sergipe (n=97), Espirito Santo (n=15) and Rio de Janeiro (n=2) (data collected over the last two nesting seasons, 2002/2003 and 2003/2004). There are records of females nesting in the state of Paraíba (56 nests in 2002-03) (Mascarenhas *et al.* 2005). The average size of females at Praia do Forte, Bahia, is 97.4 cm (ranging between 86 and 110 cm, n=34) CCL (Marcovaldi *et al.* 1999).

**The five species that inhabit the SWA are transzonal and highly migratory. They participate in trophic and reproductive migrations, during which they travel through areas where various fishing fleets operate.**

## Population genetics

In terms of the regional genetic characteristics of this species, five different haplotypes were identified in one sample taken at the nesting colony at Bahia. Those were the A haplotype, which is common in other Caribbean nesting colonies, and four new haplotypes (R, S, T and U), which have only been found at this colony. (Bass *et al*. 1996)

## Migrations

Hawksbill turtles travel considerable distances between their nesting areas and their feeding habitats. In Dakar, Senegal, an immature individual, who had been tagged at Atol das Rocas in Brazil, was recaptured. This finding implies that the turtle had traveled a minimum of 3680 km over a six month period (Marcovaldi & Filippini 1991). Another report refers to an immature individual that was tagged at Fernando de Noronha, Brazil, and subsequently recaptured at Cape Esterias, Gabon (Bellini *et al.* 2000).

Local recaptures have been recorded in the states of Bahia and Ceará. There are also records of movements between Atol das Rocas and Ceará (Marcovaldi *et al.* 2000).

During the 2004-2005 season, satellite transmitters were placed on 15 females nesting at Praia do Forte, Bahia. Although the data areare only preliminary, the majority of the individuals that were monitored have been observed to be moving along the Brazilian coastline. Nevertheless, two of those specimens traveled out to sea. One of them later returned to the Brazilian continent while the other ended up at the Trinidade island system in Espirito Santo (TAMAR Project 2005).

### Feeding areas

This species feeds on organisms associated with coral reefs, sponges being their main source of sustenance (Bjorndal 1997). In Fernando de Noronha, which is one of this species' development areas, juveniles ranging between 30.5 and 75.5 cm CCL (mean=52.3 cm, n=38) have been observed (Bellini & Sánchez 1996). In Ubatuba, São Paulo there is a mean length of 46.1 cm CCL ranging between 32.0 and 67.0 cm (for the years 1991-98, n=22) (Gallo *et al.* in press). In Rio Grande do Sul, south of the distribution area for this species, juveniles with a size range of 37.0 to 43.0 cm CCL (n=5) have been recorded (Soto & Beheregaray 1997).

## *Lepidochelys olivacea*
## Olive Ridley, Tortuga Olivacea, Tartaruga-oliva

Olive ridley turtles are distributed throughout the world's tropical and subtropical oceans (Reichart 1993). In the SWA region, they are present along the coasts of the states of Sergipe and Bahia, Brazil (Marcovaldi *et al.* 2000). There have been exceptional cases of individuals appearing along the coasts of Rio Grande do Sul and Uruguay (southern distribution limit for this species) (Frazier 1986; Soto & Beheregaray 1997; Monteiero 2004). The presence of this species has not been reported in Argentine waters (Albareda *et al*. 2003).

**IUCN, category (2002):** On a global level, this species is at risk and falls under the "Endangered" category (EN A1 abd) (Hilton-Taylor 2000; IUCN 2004).

### Nesting Areas

This species nests either alone or in groups known as "arribadas", on sandy continental beaches, with intervals of two to three years, although nesting frequently occurs during consecutive years. The main colonies in the SWA are in Sergipe, Brazil, which was home to 77.8% (n=4247 nests) of the total nests that were recorded and protected during the 2002/2003 and 2003/2004 seasons. The second most important nesting site is located on the coast of Bahia and hosted 21.9% (n=1195) of the nests during that same period. In Espirito Santo, a lesser number of nests have been recorded, (0.3%, n=14) (Marcovaldi 2001). Other nearby nesting colonies are located in French Guiana (500 nests in 1999) as well as Suriname (200 nests in 1999). Small nesting colonies are also distributed throughout the Gulf of Guinea in Africa (Marcovaldi 2001). The mean shell size of egg laying females in Guyana is 68.1 cm CCL. In Suriname, it varies between 63 and 75 cm CCL (mean=68.5 cm, n=500) (Marcovaldi 2001).

**Olive ridley turtles are distributed throughout all of the world's tropical and subtropical ocean waters (Reichart 1993). They nest every two to three years, either alone or in large groups called "arribadas".**

## Juvenile Development Areas

Development takes place in tropical coastal and pelagic zones (Reichart 1993). Adults between 58 and 79 cm CCL (mean=67 cm ± 6.5 cm) have been reported in Rio Grande do Sul (Monteiro 2004). Immature individuals with shell lengths between 47 cm and 61 cm CCL have been reported in Uruguay, which is the southern distribution limit for this species (López-Mendilaharsu *et al.* in press).

## Population Genetics

In terms of population structure, two haplotypes (E and F) have been identified for the South Atlantic. These are characteristic of individuals belonging to the nesting colonies in Suriname, Brazil and Guinea Bissau (Bowen *et al.* 1998).

## Migrations

As a result of recapturing of tagged specimens, migratory movements along the coasts of Venezuela, the Guianas and Brazil have been determined (Reichart 1993). In the region, egg laying females, which were tagged at Pirambú, Sergipe, have been recaptured in the states of Alagoas, Bahia and Santa Catarina, Brazil, (Marcovaldi *et al.* 2000).

## Feeding areas

This species is mainly carnivorous, its diet consisting primarily of crustaceans and invertebrates (Reichart 1993, Bjorndal 1997). Its preferred feeding areas are located near estuaries and bays with a great deal of biological productivity. At Rio Grande do Sul, the stomach contents of a stranded specimen were examined, revealing the remains of bony fish, cirripede crustaceans and one species of gastropod (Pinedo *et al.* 1998).

## Conclusions

The life cycles of sea turtles are long and complex. Throughout their lifetimes, individuals inhabit diverse ecosystems (nesting beaches as well as coastal, neritic, oceanic, pelagic and demersal areas), transcending Exclusive Economic Zones and International Waters.

This extensive geographical distribution in addition to the broad range of turtle migrations, leads to interaction with virtually all types of fisheries.

According to the definition of FAO, the five species that inhabit the SWA are transzonal and highly migratory (FAO, 1994). They undertake reproductive and feeding migrations through waters where many different fishing fleets operate. These circumstances create a need for a regional level approach to biological, fishery and conservation studies, as the only means for achieving the sustainability of sea turtle populations.

# National and international legal framework pertaining to the SWA

## International legislation

Argentina, Brazil and Uruguay have signed, approved and ratified some of the following international conventions, by passing related national legislations:

**a. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Washington D.C., 1973**

This convention has three appendices that classify different species according to their risk levels. The five sea turtle species found in the Southwestern Atlantic are protected under Appendix 1 of the convention, which means that they are either endangered and are or can be affected by trade.

**b. Convention on the Conservation of Migratory Species of Wild Animals (CMS) Bonn, 1979**

This convention recognizes the importance of migratory species and has two appendices that classify different species according to their risk levels. The species of sea turtles that are present in the SWA are listed in Appendix I of the convention, which means that countries should make immediate efforts to protect them.

During the sixth meeting of the Conference of the Parties of this convention, Resolution VI/2 on "By-catch", which deals with the problems that sea turtles face as a result of incidental fishing, was adopted. At the seventh meeting of the Conference of the Parties, the members adopted Resolution VII/6 "on improving the conservation status of the leatherback turtle (*Dermochelys coriacea*)". Argentina and Uruguay are parties to the CMS, while Brazil has not yet signed on to the convention.

**c. Convention on Wetlands of International Importance (RAMSAR, 1971)**

This convention recognizes shallow marine areas close to the coast line as wetlands to be protected. This is directly related the protection of the habitats utilized by sea turtles.

"The RAMSAR convention will work, within the framework of its Joint work plan with the Convention on the Conservation of Migratory species of Wild Animals (CMS), to promote the protection of important sea turtle habitats through the designation of these areas as wetlands of international importance."

**d. Convention on Biological Diversity. Rio de Janeiro, 1992**

This convention is the first integrated international agreement that deals with all aspects of biological diversity: genetic resources, species and ecosystems. Decision "V" on "Marine and Coastal Biological Diversity", made during the seventh meeting of the this convention's Conference of the Parties, discussed the need for creating a broader program of work on marine and coastal biological diversity. This program aims to prevent the loss of marine and coastal biological diversity on a national, regional and global level.

**e) United Nations Convention on Rights of the Sea (CONVEMAR), New York 1982**

CONVEMAR establishes a comprehensive framework for the use and development of the oceans. It specifies the rights of each nation as well as the responsibilities, general objectives and principles that will guide their use of the ocean. Article 61.4 on "Conservation of living resources", discusses the possible incidental capture of marine animals that may occur as a result of fishing activities. It clearly states that the nations that are parties to this convention "will take into account the effects on species associated with or dependent on the captured species, with the goal of preserving or reestablishing the populations of those species so that they may achieve levels above those which might severely threaten their reproduction."

**f) Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) - San Jose, 2001**

This convention's geographical area is made up of the terrestrial territories of every one of its signatory parties on the American continent, as well as their respective maritime zones in the Atlantic and Pacific Oceans and the Caribbean Sea. These maritime zones correspond to those belonging to each of the parties, or to the areas over which they have jurisdiction in terms of the use of living marine resources. The objective of the convention is to promote the protection, conservation and increase in the populations of sea turtles as well as protecting the habitats that they depend on. This task is to be accomplished based on the most trustworthy, available scientific data and taking into account the environmental, socioeconomic and cultural characteristics of each party.

Brazil is the only one of these three countries that has approved the text of the convention via Federal Legislative Decree Number 91, issued in 1999. The Republic of Argentina, acting through its Environmental and Sustainable Development Secretariat, started a file in 2004 containing technical recommendations that justify and emphasize the importance of adhering to the Interamerican Convention for the Protection and Conservation of Sea Turtles (IAC). The Eastern Republic of Uruguay is also in the process of ratifying the Convention, which it signed in 1998.

During the COP2 (Venezuela, November of 2004), a resolution on leatherback turtles was adopted, which is the first IAC resolution with immediate implications. This resolution calls for the creation and/or implementation of conservation plans, the execution of direct measures for protecting nests and nesting habitats, reducing turtle mortality in fisheries and the use and consumption of

**Despite all efforts, none of these laws prevents sea turtle bycatch.**

leatherback products, as well as the collection and distribution of information about this species' interactions with fisheries. It also calls on non-signatory countries whose activities affect this species to adopt conservation measures in addition to establishing and strengthening agreements and alliances between the different organizations.

## National legislation

| Legislation in effect in Argentina | | |
|---|---|---|
| **Type of legal instrument and corresponding number** | **Description** | **Scope/ Range of Application** |
| National Law 22.421 of 1981, Regulation Decree 666/97 and its complementary norms | Regulations for the Protection and Conservation of Wildlife. | National |
| Resolution 1089 of 1998 | Secretariat of Natural Resources and Sustainable Development , "The hunting, interprovincial trade and exportation of the many species of wild animals or products derived from those species is prohibited" | National |
| Resolution 3 of 2001 | Federal Fishing Council, Program of Onboard Observers, Follow-up on Bycatch. This Resolution makes the National Institute of Fishery Research and Development (INIDEP), through its Program of On Board Observers, responsible for keeping track of the bycatch of reptiles, birds and marine mammals during fishing expeditions. | National |
| Resolution 91 of 2003 | Secretariat of the Environment and Sustainable Development's adoption of the National Strategy for Biological Diversity. | National |

| Legislation in effect in Uruguay | | |
|---|---|---|
| **Type of legal instrument and corresponding number** | **Description** | **Scope/ Range of Application** |
| Wildlife Law 9481/1935 | Gives the state the power to administrate and regulate the use of wildlife and prohibits the hunting of wild zoological species. | National |
| Law 13833/1969, Riches of the sea | Declares the exploitation, preservation and study of the sea's riches to be a matter of national interest; declares the country's national sovereignty over its territorial waters and institutes regulations for fishing and aquatic hunting. | National |
| Law 16320/1992, Rendering of Accounts and Balancing of Budget Execution of the Exercise 1991. | Article 208 grants police, customs officials, and inspectors of the Department of Wildlife and General Natural Resources Directorate, the authority to control and punish crimes involving wildlife throughout the nation. | National |
| Decree 164/1996 | A regulatory instrument of the Wildlife Law and its subsequent norms: It is the law's basic regulatory instrument, which contains the definitions of a "hunting act", hunting for sport, commercial hunting, pest control hunting, hunting for scientific purposes, and free hunting. This decree regulates the use and destination of confiscated animals and animal products. It prohibits the hunting, transportation, possession, sale and industrial processing of wildlife species, with the exception of those species that have been declared plagues or that are products of regulated hunting or farming. | National |
| Law 16736/1996 | Art. 275- Grants the Ministry of Livestock, Agriculture and Fishery the authority to issue hunting licenses.<br>Art. 285-Establishes the punishments for infractions. | National |
| Decree 144/1998 | Prohibits the capture, holding and transportation as well as the sale, transformation or processing of the four species of sea turtles present in Uruguay. In its second article, it states that sea turtles that are captures during fishing operations must be returned to the sea immediately. Finally, in its fifth article, it grants zoos, scientific and educational institutions exemptions from the prohibition on the possession of sea turtles, dead or alive, as well as sea turtle parts, as long as they are to be used for educational or research purposes. | National |
| Decree 514/2001 | Updates the official list of vertebrate tetratapod species of wildlife, which includes the 4 species of sea turtles present in Uruguay. | National |

**Legal instruments will only be effective, if they go along with stronger enforcement measures and continued education, in order to achieve the commitment of all parties involved.**

| Legislation in effect in Brazil | | |
|---|---|---|
| **Type of legal instrument and corresponding number** | **Description** | **Scope/ Range of Application** |
| State Law Nº 003574 of 8/24/1983 | Authorizes the Executive Power to donate the Regiao Leste Biological Park, located in "ilha dos comboios", an area which is delimited by decree n° 2446-e, of October 8, 1982 to the Federal Union. The objective is to create a biological reserve for turtle nesting. | State/ Espirito Santo |
| SUDEPE Provision Nº 0000G5 of 1/31/1986 | Prohibits the capture of any species of sea turtle. | Federal |
| IBAMA Provision Nº 000186 of 2/22/1990 | Establishes the National Marine Turtle Conservation and Management Center - TAMAR. | Federal |
| IBAMA Provision Nº 000010 of 1/30/1995 | Prohibits the transit of any type of vehicle in coastal zones, which are understood to be between the lowest water line and 50 meters past the highest tide line of the year, on sea turtle nesting beaches. | Federal |
| IBAMA Provision Nº 11 of 1/30/1995 | Prohibits any source of light which emits more than zero lux, along a stretch of beach that extends from the lowest tide line to 50 meters past the highest tide line of the year, in egg laying areas, from the Farol de São Tomé in Rio de Janeiro to the State of Espirito Santo, and encompassing southern Bahia, the beaches of Farol de Itapua, in Salvador, Ponta dos Mangues in the State of Sergipe, Pirambu (Sergipe) to Penedo in the state of Alagoas and the beaches of Fernando de Noronha and la Praia da Pipa, in Rio Grande do Norte. | Federal |
| IBAMA Provision Nº 001535 of 8/15/1995 | Creates the Technical Group, which coordinates the actions that will be taken by IBAMA with regards to the use of TED (Turtle Excluding Devices), by the shrimp trawling fleet. | Federal |
| CONAMA Resolution Nº00010 of 10/24/1996 | Deals with the environmental licenses provided for in Law number 6.938/81 and Decree number 99.274/90 on beaches where turtles lay their eggs, which may only be made effective following the evaluation and recommendations of IBAMA and the Marine Turtle Center-TAMAR. | Federal |
| IBAMA Provision Nº 000074 of 9/12/96 | Calls for the mandatory use of Turtle Excluding Devices, also called TEDs, to be incorporated into the trawl nets utilized by industrial boats with shrimping permits on the Brazilian coast, regardless of the target species. | Federal |
| IBAMA Nº Provision 000005 of 2/19/1997 | Makes the use of Turtle Excluding Devices (TED) mandatory along the entire coastline, in shrimp trawl nets used on boats longer than 11 meters, which do not employ manual nets or methods. | Federal |

| Legislation in effect in Brazil | | |
|---|---|---|
| **Type of legal instrument and corresponding number** | **Description** | **Scope/ Range of Application** |
| State Law Nº 7034 of 1997 | Prohibits any light source that emits more than zero lux, along a stretch of beach that extends from the lowest tide line to 50 meters beyond the highest tide line of the year, on nesting beaches including the beaches that extend from the border of Bahia with Espirito Santo to the Corumbau river and from the Farol de Itapua (Salvador) to the border with Sergipe. | State (Bahia) |
| Law on Environmental Crimes - IBAMA – Law nº. 9.605, of 2/12/98 | Prohibits the use or consumption of sea turtle meat, eggs and shells. | Federal |
| MMA Normative Instruction Nº0003 of 5/27/2003 | Recognizes 5 species of sea turtles as endangered Brazilian wildlife | Federal |
| MMA Normative Instruction Nº 000031 of 12/13/2004 | Modifies the technical specifications for Turtle Excluding Devices, also known as TEDs. | Federal |
| IBAMA Provision Nº 000006 of 1/26/2005 | Establishes the southern coordinating body of the National Marine Turtle Conservation and Management Center- TAMAR – with the goal of coordinating institutional actions and executing research, management and conservation activities that focus on the region's sea turtles. | Federal |

## Conclusions

It is very difficult to assess the efficiency of national and international legal instruments, in terms of the effective protection they provide for sea turtles.

As illustrated by the information collected, the countries inside the SWA region have by-and-large adopted the existing international legislation. On a national level, Brazil has the largest number of laws, decrees and provisions related to sea turtle conservation.

In some cases, specific legislation related to interaction with fishing vessels, such as laws that make the use of turtle excluder devices (TEDs) mandatory, does exist. The capture of sea turtles is also explicitly prohibited. However none of these laws eliminates the bycatch of sea turtles.

We believe that some regional legal instruments may be necessary, although, like the existing ones, they will only be effective if they are accompanied by greater permanent control and education measures, thus establishing a commitment on the part of all the parties involved.

# Compilation and analysis of the existing literature

## National Legislation

The existing information was compiled from magazine articles, conference papers, theses and reports regarding sea turtles and their interaction with the different fisheries that operate in the Southwestern Atlantic (SWA) as well as papers and articles on strandings. The information that was compiled, was analyzed in terms of the possibilities offered by each format, in order to get an overall picture of all the knowledge gathered to date, organized according to turtle species and types of fishing.

Although there is a wealth of information about fisheries and sea turtles, much of this information consists of communications issued at conferences, of which only the summaries are available, making them difficult to evaluate. Annex I contains a bibliography of all the regional information that was compiled regarding fisheries, strandings and their interaction with sea turtles .

Analysis of the papers that were compiled regarding sea turtles, which are in some way related to fisheries, shows that the majority of these documents (70%) were conference presentations (74 in total). There are a total of 9 reports, monographs and chapters from books, which constitute 7% of the total documentation. Eight articles were published in the Marine Turtle Newsletter accounting for 7%, and the articles published in magazines with greater circulation number 18 in total, representing 16% (Fig. 1). The papers date as far back as 1942, although 90% of them were published between 1997 and 2004, which indicates that a great deal of research has been conducted over the last few years.

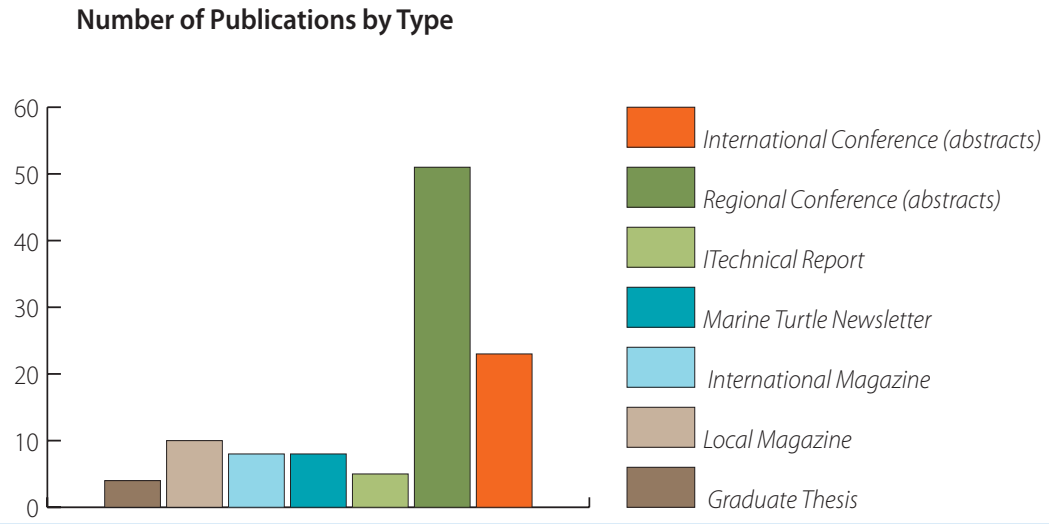



**Figure 1.** Number of publications that include information on strandings and sea turtle interaction with fisheries, grouped by type of publication.

The *Caretta caretta, Dermochelys coriacea* and *Chelonia mydas* species are mentioned in the greatest number of papers, 75, 70 and 69 documents respectively (Fig. 3). In terms of the papers on each specific species, *D. coriacea* is the subject of most of these (eleven papers), followed by *C. mydas* (ten papers) *C. caretta* (seven) and *L. olivacea* (three).

The fisheries that have been the subject of most of the research are gillneting (42%), pelagic longlining (28%) and trawling (16%). Compared to the region's other countries, Brazil accounts for the greatest number of publications (62), representing 57% of the total. Uruguay and Argentina follow, with 24 and 18 papers respectively (Fig 4). Five of the papers contain regional data, three dealing with the SWA region, one with data from Uruguay-Argentina and one with data from Brazil-Uruguay.

Laporta *et al.* (2004) conducted an analysis of the distribution of the operation zones of industrial fisheries (trawling and longlining) that interact with sea turtles in the SWA (Figures 5 and 6). They also compiled a portion of the bibliography consisting of the works published up until 2004. Their analysis showed that a significant number of fishing boats operate out of the ports of the SWA, encompassing a very extensive area that includes turtle reproduction areas, feeding areas and migration corridors, used by all five species that inhabit the region. Trawlers and longliners operate in coastal and deep waters, interacting with immature individuals and adult turtles. The impact of fisheries on sea turtle populations in this region has not yet been quantified. This analysis does not include artisanal fishing vessels, which are broadly distributed along the entire coast line. The regional impact of artisanal fishing vessels has not yet been evaluated due to insufficient data and the difficulty of standardizing their effort.

Some data are available for evaluating and discerning the spatial and temporal distribution of sea turtles in the SWA. However, the area for which these data are available represents only a small portion of the areas where industrial fishing fleets operate in the region (Figures 5 and 6).

Of all the papers that were analyzed (n=109), 48% contain reference to a specific timeframe. Of these, 21 cover a period of a year or longer.

In terms of spatial relationships, 54% ofpapers (n=59) refer to areas smaller than 1º by 1º and/or geographical positions. Sixteen other papers (14%) are less precise in terms of spatial relationships, containing highly variable zonal definitions that exceed 1º by 1º in every case.

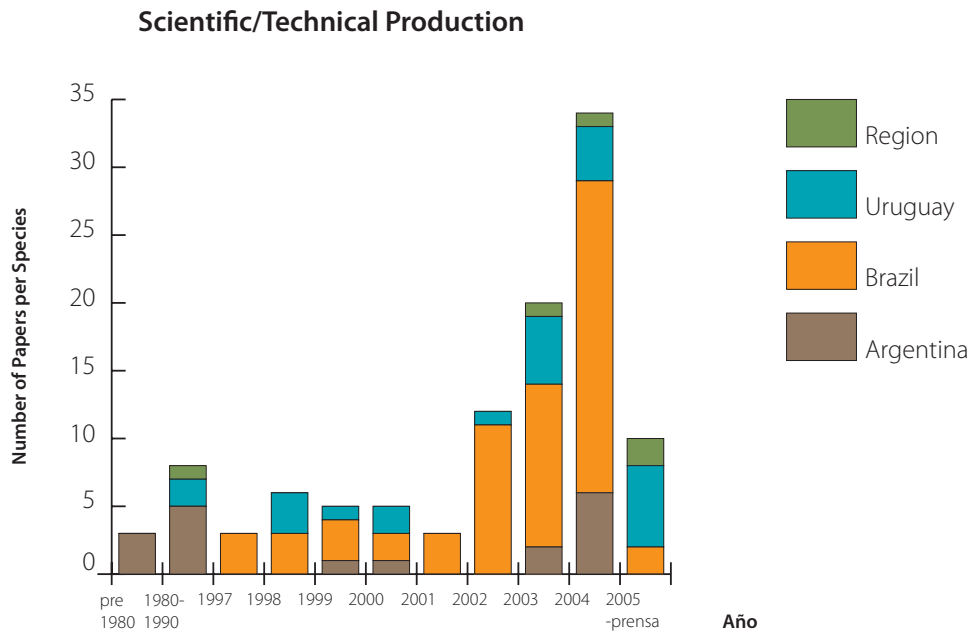



**Figure 2.** Number of publications per year, related to strandings and interaction of fisheries with sea turtles.

With regards to quantitative aspects, 38% of papers (n=42) provide information on bycatch. Of these, only six provide analyses of relative abundance (Catch per Unit Effort).

Figure seven was created after extracting quantitative information regarding the interaction between fisheries and sea turtles from the existing body of work. The map clearly shows large areas of the SWA, including coastal areas, for which there is no available information.

If we consider only papers that contain a clearly defined spatial framework as well as quantitative data including fishing effort, which make it possible to generate relative abundance values for each species, the area becomes markedly smaller. It now encompasses only southern Brazil, Uruguay and the adjacent international waters (Figure 8).

If we analyze the information containing references to the afore mentioned values as well as seasonal timeframes, information covering a year or more with fishing effort data that allows fishery and sea turtles to be evaluated, and also deals with environmental issues, the area is reduced even further. The fishing vessels for this area are also made up almost exclusively of longliners (Figure 9).

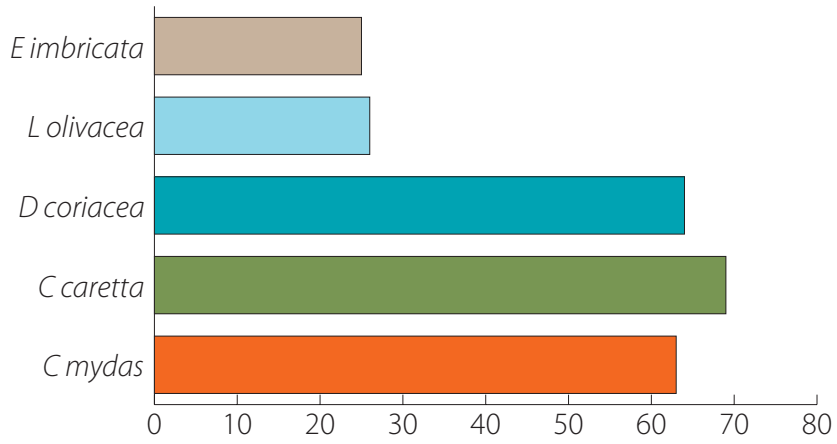



**Figure 3.** Number of papers per species, which include information regarding strandings and sea turtle interaction with fisheries (109 papers analyzed).

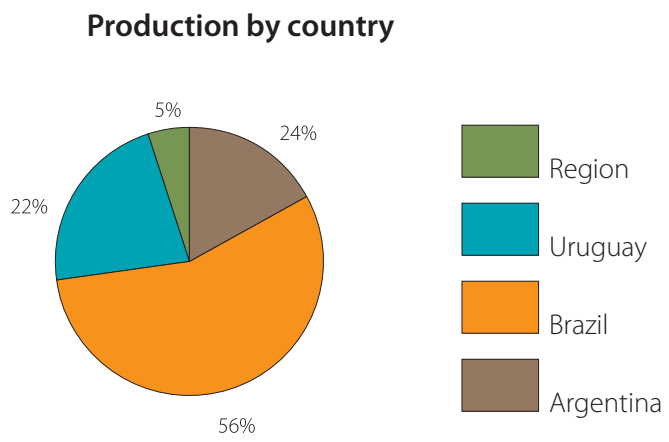



**Figure 4.** Percentage of papers written per country (104 papers analyzed), which include information regarding sea turtle strandings and interaction with fisheries.


**Figure 5a.** Maps showing the operation areas of the trawling fleets of Argentina (extracted from Laporta *et al.* 2004).

## Fishing areas with bottom trawling net – Uruguay

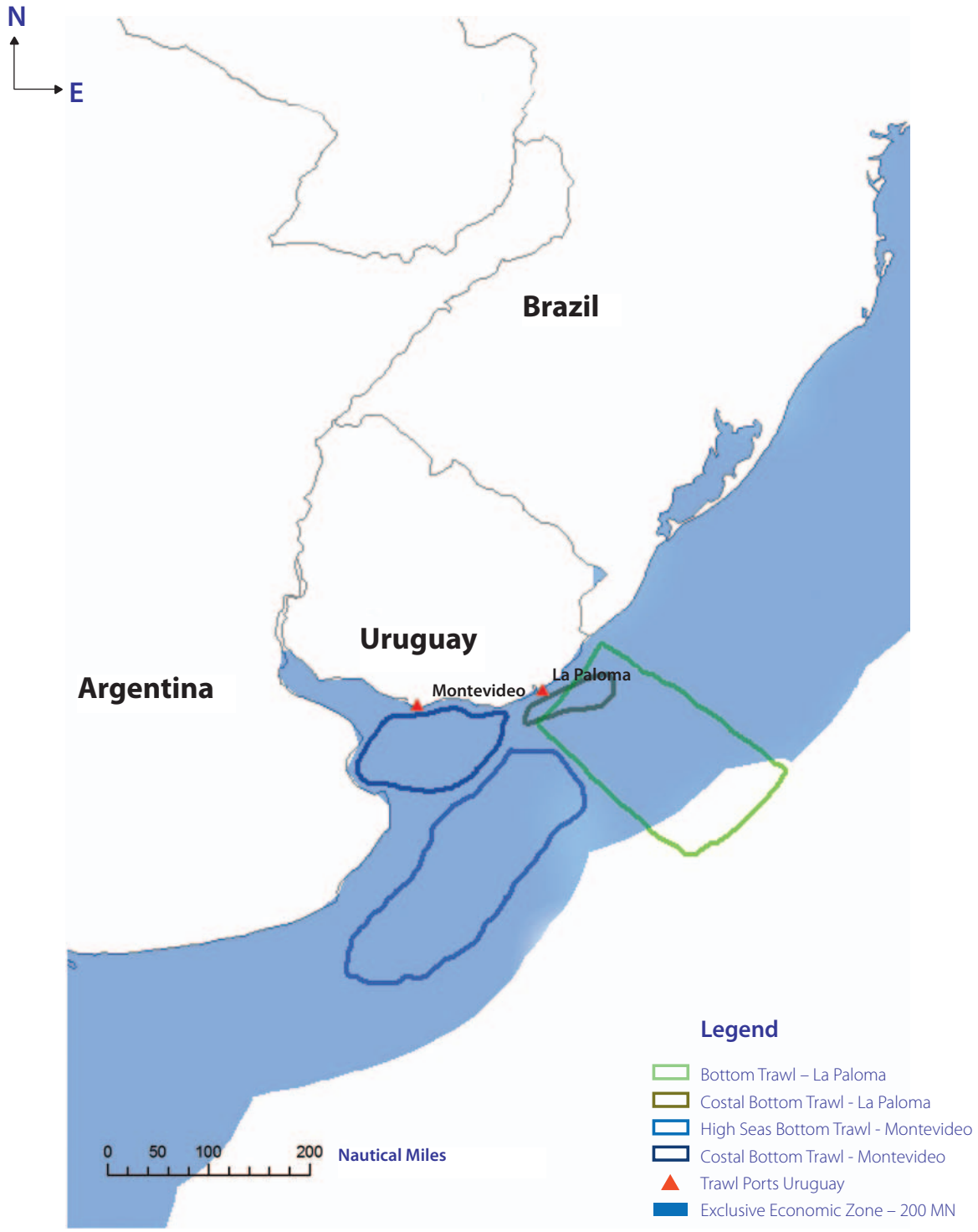



**Figure 5b.** Maps showing the operation areas of the trawling fleets of Uruguay (extracted from Laporta *et al.* 2004).

## Shrimp fishing areas with bottom trawling net– Brazil

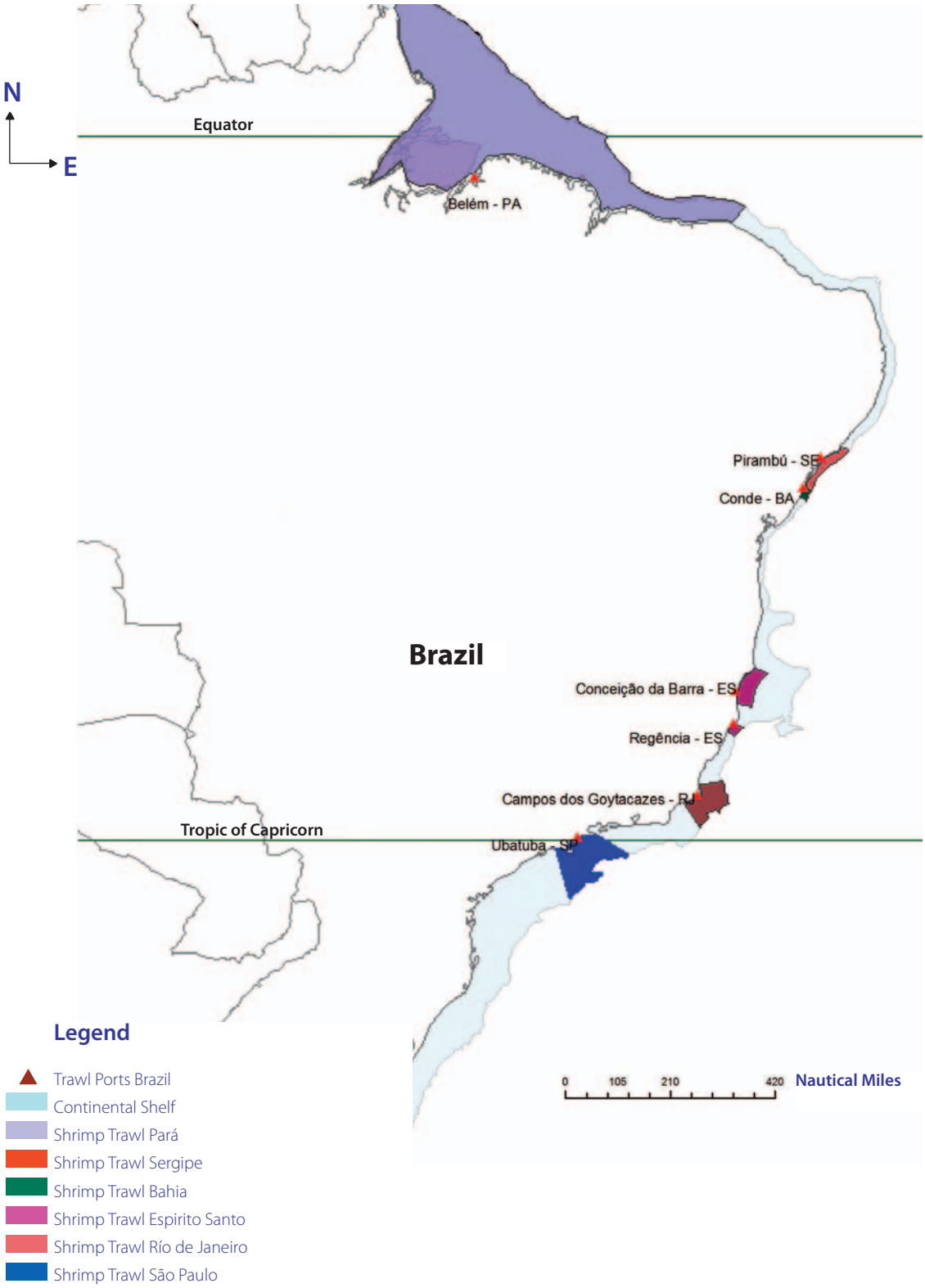



**Figure 5c.** Maps showing the operation areas of the trawling fleets of Brazil (extracted from Laporta *et al.* 2004).


**Figure 6.** Map showing the operational areas of the Brazilian and Uruguayan longline fleets (extracted from Laporta *et al.* 2004).

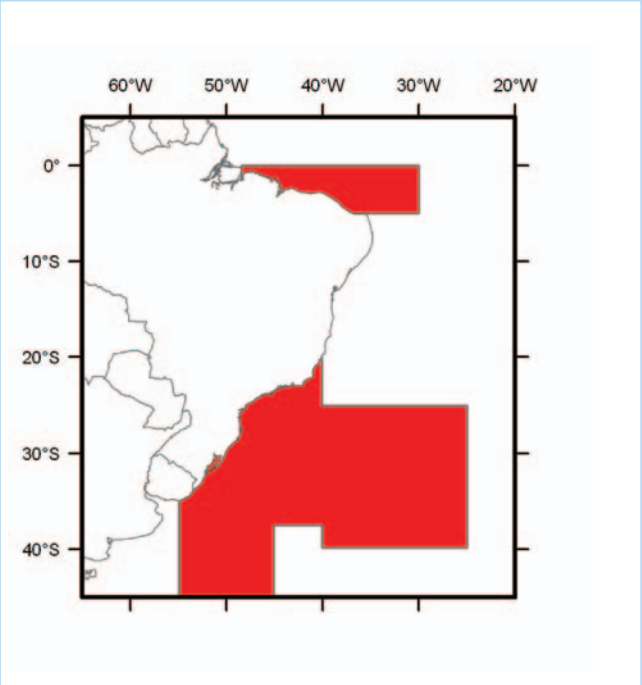



**Figure 7.** Areas for which there is spatial and temporal information and which provide quantitative data.

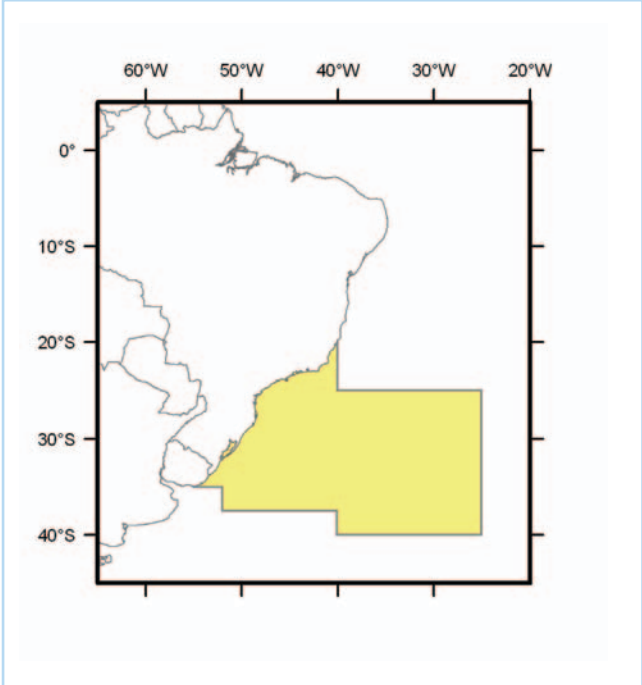



**Figure 8.** Areas for which there is information containing a time framework as well as quantitative data regarding the bycatch of sea turtles, which allow CPUE values to be generated.

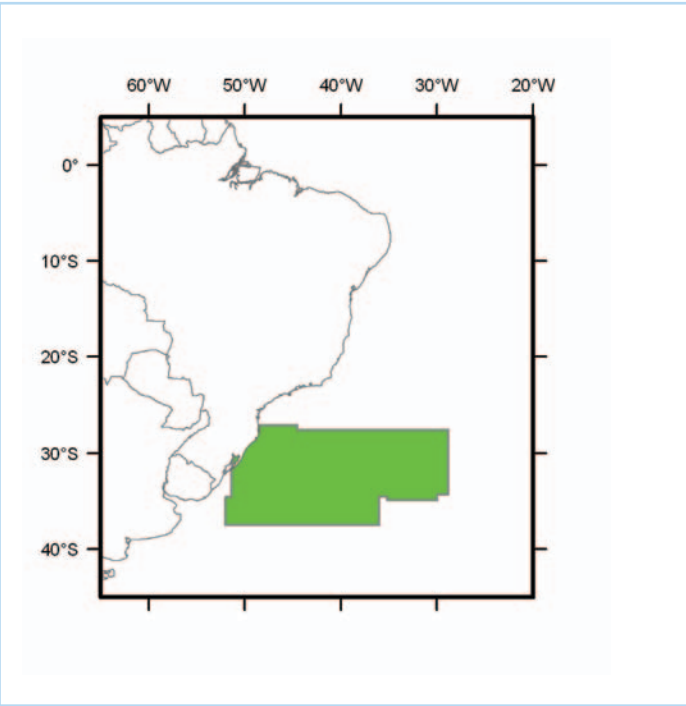



**Figure 9.** Area for which there is information regarding fishing effort, sea turtle bycatch and environmental data. This area is reduced almost exclusively to southern longline operational zones.

# Fishing Gear

## Trawling

In the SWA there are a variety of fisheries that utilize these techniques, primarily coastal bottom trawling. This type of fishing includes otter board and double rig trawling for fish and shrimp, pair trawling for fish and the use of dredges for fishing conch. The techniques are used by artisanal and industrial fleets.

These fisheries are the most important in terms of the number of boats in southern Brazil, Uruguay and Argentina, where the extensive continental shelf and the muddy or sandy bottom make this gear favorable.

Although the incidental capture of sea turtles using these gears has been recorded, information that allows these incidents to be quantified according to *catch per unit effort* (CPUE), in order to evaluate the magnitude of the impact of this type of fishing, has not yet been published. The few data of incidental capture that have been recorded to date, show a large incidence of turtle mortality due to the long duration of trawling runs, which generally last between 4 and 6 hours for coastal bottom pair trawling conducted by the Uruguayan fleet, depending on the season. This type of fishing takes place on the continental shelf at depths between 5 and 40 meters. The trawl nets used in the coastal regions of Uruguay and Argentina have a vertical aperture of up to 3.5 meters and a horizontal aperture of up to 30 meters, which facilitates the bycatch of sea turtles including the *D. coriacea* species. There are currently around 507 Brazilian vessels, 68 Uruguayan vessels and 205 Argentine vessels operating using bottom trawls (Laporta *et al*. 2004). What follow are the results of the most detailed papers, found during the bibliographic research.

- Albareda *et al*. (2003) observed that 15 *C. mydas*, 5 *C. caretta* and 8 *D. coriacea* were caught by coastal trawlers from Argentina between 1999 and 2003.

- Miller *et al*. (in press b) observed that 36 *C. caretta*, 7 *C. mydas* and 3 *D. coriacea* were caught by five coastal trawlers between April of 2002 and February of 2004, in the Rio de la Plata estuary.

## Gillnets

Gillnetting is practiced by artisanal and industrial fishermen and consists mainly of bottom gillnetting for most of the boats throughout the region. This technique is used primarily for fishing Croaker (*Micropogonias furnieri*), Striped Weakfish (*Cynoscion guatucupa*) and Hake (*Urophycis* sp.) Other gillnetting gear such as pelagic driftnets are used for catching bony fishes and pelagic sharks in Brazil along the coast and extending into very deep waters, as are bottom nets for lobster fishing (NE Brazil).

**The enormous pressure that is being exerted by fishing fleets in the area has not been accompanied by an increase in information regarding the bycatch of species with no commercial value.**

Although the existing regional data do not cover a very broad area or timeframe, they are evidence of significant turtle mortality due to the length of the time that the nets are set for, which in many cases and depending on the fishing, may be anywhere from 12 to 24 hours or sometimes longer.

Lezama *et al*. 2004 observed a mortality rate of 49.3% in Uruguay caused by bottom gillnets during the years 2002 and 2003, for a total of 73 incidental captures (94.5% of which were of *C. mydas*). Sales *et al.* 2003 observed that pelagic driftnets utilized by the Brazilian fleet are a significant threat to sea turtles, as the incidental capture of 163 individuals of the *D. coriacea* species using that type of gear was recorded between January of 2002 and March of 2003.

**Due to the variety of fisheries operating in the area, a regional and international effort is needed in order to compile information on bycatch.**

### Pelagic Surface Longlining (local fleets)

In the SWA, the target species of this fishery are tuna and tuna like fish, swordfish and pelagic sharks. There are many longliners operating in the EEZs of Brazil and Uruguay, as well as the international waters of the SWA. It is mainly an industrial fishery. There are currently approximately 127 Brazilian boats and 12 Uruguayan boats of this type (Laporta *et al*. 2004). There are also artisanal surface longliners who target mahi-mahi, also known as dolphin fish (*Coriphaena hippurus*), in the state of Espirito Santo in Brazil, made up of about 294 boats. At this time, there are no Argentinean pelagic longliners. Surface longlining is the fishing method that is being monitored most closely by the government agencies in charge of managing marine resources. This monitoring is accomplished through a sampling system, which has been in place for several years. That system has helped generate information regarding sea turtle CPUE, for the Brazilian and Uruguayan fleets. There are significant mesoscale spatial-temporal variations in the area, documented in the works of Domingo *et al*. (2003), Miller *et al*. (in press) and Sales *et al*. (2004) among others. The data obtained as a result of monitoring reflect a major impact in some areas, primarily in the southern SWA, with a large incidence of bycatch of both *Caretta caretta* and *Dermochelys coriacea*. What follows is a list of the results that were found while reviewing the literature:

- Achaval *et al*. (2000) observed that during nine fishing trips (99 sets, 90,194 hooks) between 1994 and 1996, 73 *C. caretta* and 32 *D. coriacea* were caught. The mortality rate was 1.9%, although all the live turtles that were set free (98.1%) still had hooks in their mouths. The CPUE was 0.81 turtles/1000 hooks for *C. caretta* and 0.35 turtles/1000 hooks for *D. coriacea*.

- Domingo *et al*. (2003) observed that during ten trips (153 sets, 143,695 hooks) between April 1998 and November 2000, 170 *C. caretta* y and 27 *D. coriacea* were caught incidentally. The CPUE reached 1.18 turtles/1000 hooks for *C. caretta* and 0.19 turtles/1000 hooks for *D. coriacea*.

- Soto *et al*. (2003) observed that during five trips (78 sets, 78,150 hooks) between June 2001 and July 2003, 11 *D. coriacea* and 213 *C. caretta* were caught. The CPUE was 2.70 turtles/1000 hooks for *C. caretta* and 0.14 turtles/1000 hooks for *D. coriacea*.

- Kotas *et al*. (2004) observed that during three trips (34 sets, 33,650 hooks) in 1998, a total of 145 *C. caretta* and 20 *D. coriacea* were caught. The CPUE was 4.31 turtles/1000 hooks for *C. caretta*, and 0.59 turtles/1000 hooks for *D. coriacea*.

- Domingo *et al*. (2004) observed that 283 *C. caretta*, 59 *D. coriacea* and 2 *C. mydas* were caught during 13 fishing trips between April 1998 and November 2002.

- Pinedo *et al.* (2004) observed that 16 *C. caretta*, 1 *D. coriacea* and 2 unidentified turtles were caught during 41 sets (12.870 hooks) between November 1996 and August 1999, in the southern Brazilian EEZ, representing a total CPUE of 1.48 turtles/1000 hooks.

- Miller *et al*. (in press a) observed that 72 *D. coriacea* were caught between 1998 and January of 2004 during 450 sets (647,722 hooks) in the Uruguayan EEZ and the international waters of the SWA.

The information obtained from different papers regarding pelagic longlining shows a large degree of spatial-temporal variability with regards to the relative abundance of sea turtles in the SWA.

This is due to the existence of areas containing higher turtle concentrations as well as areas with a higher concentration of fishing effort.

The analysis of the information taken from fishing boats reflects fishing effort and does not necessarily indicate the distribution of sea turtle species.

Although some of the documents that were analyzed show a high rate of sea turtle bycatch, further research is needed in order to understand the distribution patterns of these species.

## Pelagic Surface Longlining (International fleets operating inside the SWA)

International pelagic surface longline fleets directed especially at tuna species (Scombridae), swordfish (*Xiphias gladius*)and billfishes (Istiophoridae) have been operating in the SWA since 1950. Those fleets come from Brazil and Uruguay as well as nations such as Japan, China, Chinese Taipei, Spain, South Africa and Namibia. With the exception of the Brazilian and Uruguayan national fleets, there are very few data available regarding the bycatch of sea turtles by those fleets. Another limitation has to do with the fact that the bycatch data are compiled by official organizations such as the Food and Agriculture Organization of the United Nations (FAO) and the International Commission for the Conservation of Atlantic Tuna (ICCAT), which often rely on insufficient statistics regarding sea turtles. ICCAT is currently requesting that all its member nations submit any relevant data regarding sea turtle bycatch (Res.03-11), in order to help get a global perspective of the problem. In response to this issue, the ICCAT Bycatch Subcommittee has prepared a chart containing information regarding the various species that are caught using different fishing gear directed at tuna and tuna like species in the Atlantic Ocean and the Mediterranean Sea (Annex II). While this chart may not provide enough information to assess the levels of bycatch, it does show the different species that interact with fishing gear. Purse-seine nets are the type of gear which interacts with the most species of sea turtles (5), followed by gillnets, with which four species interact, longlines, with which 3 species interact, harpoons (2 species) and pound nets and other gear with one species. This table also establishes that fishing vessels using live bait do not interact with sea turtles.

**Table 1.** Summary of the data collected on sea turtle bycatch inthe pelagic surface longline fisheries of SWA countries.

| Publication | Timeframe | Trips | Sets | Hooks | # *C. caretta* | CPUE *C. caretta* | # *D. coriacea* | CPUE *D. coriacea* | Total CPUE |
|---|---|---|---|---|---|---|---|---|---|
| Achával *et. al* (2000) | 1994-1996 | 9 | 99 | 90.104 | 73 | 0,81 | 32 | 0,36 | 1,18 |
| Domingo *et al.* (2003) | Apr/98 – Nov/00 | 10 | 153 | 143.695 | 170 | 1,18 | 27 | 0,19 | 1,33 |
| Soto *et al.* (2003) | Jun/01 - Jul/03 | 5 | 78 | 78.150 | 213 | 2,73 | 11 | 0,14 | 2,85 |
| Kotas *et al.* (2004) | 1998 | 3 | 34 | 33.650 | 145 | 4,31 | 20 | 0,59 | |
| Domingo *et al.* (2004) | Apr/98 - Nov/02 | 13 | | | 283 | | 59 | | |
| Pinedo *et al.* (2004) | Nov/96 - Aug/99 | | 41 | 12.870 | 16 | 1,24 | 1 | 0,08 | 1,48 |
| Miller *et al.* (en prensa a) | 1998 - Jan/04 | | 450 | 647.722 | | | 72 | 0,11 | |
| Sales *et al.* (2004) | 1999-2003 | 39 | 530 | 585.521 | 265 | 0,45 | 113 | 0,19 | 0,68 |

With regards to observer programs, there are nations, such as Canada and Mexico, which belong to ICCAT and have observer programs, but which do not operate inside the SWA. The only countries that operate inside the SWA and have observer programs in place are Brazil, Spain and Chinese Taipei (ICCAT 2005)

Due to market and resource management variables, the magnitude and spatial distribution of the pelagic longline fishing effort are quite dynamic and difficult to evaluate. On the SWA level there are not enough data with the sufficient spatial and temporal details necessary to conduct a thorough analysis of pelagic longline fishing effort over the last few years. Some papers, such as the work of Lewison *et al.* (2004), which contains estimates of fishing effort for the year 2000 broken down into 5º x 5º cells (Figure 10), offer partial information. Tuck *et al*. (2003) estimated that between 1986 and 1998, the fleets that report to ICCAT exercised a fishing effort of somewhere between 10 and 30 million hooks per year, west of 40ºW and between 30ºS and 40ºS, directed mainly at albacore (*Thunnus alalunga*).

**There is a very limited amount of information available regarding sea turtle bycatch by fisheries from non-coastal nations inside the SWA.**

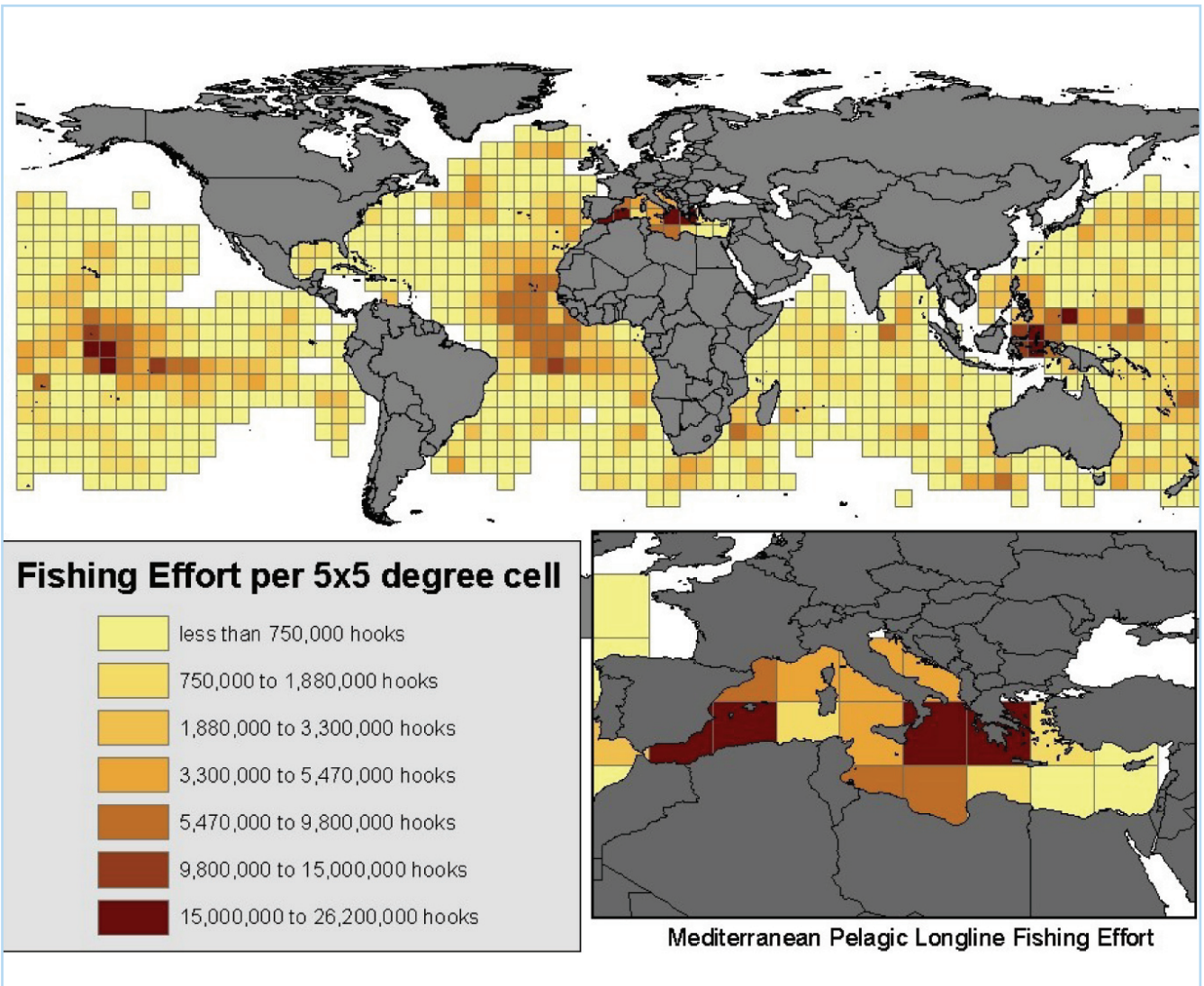



**Figure 10.** Map showing the pelagic longline fishing effort reported for the year 2000, taken from Lewison *et al*. (2004).

## Japan

The Japanese fleet was the first to use pelagic surface longliners in the SWA (starting in the mid 1950s). Longlines are currently the only type of fishing gear used by the Japanese for fishing tunids in the Atlantic Ocean. Other types of fisheries, live bait and purse-seine nets, ceased to operate in the Atlantic in 1984 and 1992 respectively (ICCAT 2005). The fishing effort was initially directed at albacore (*Thunnus alalunga*) and yellow fin (*Thunnus albacares*), later turning to big eye tuna (*Thunnus obesus*) in the 1970s. This last species currently accounts for half of the Japanese fleet's total catch in the Atlantic ocean, with 23,690 tons caught in 1999 (Hazin *et al*. in press).

The Japanese fleet's fishing effort has been distributed throughout the Atlantic Ocean since the late 1970's, however, most of it has been concentrated in the Gulf of Guinea (between 20ºS and 10ºE to 20ºW). Japan's annual fishing effort in the Atlantic Ocean, fluctuates between 146 and 320 longliners, which use anywhere from 40 to 90 million hooks (Hazin *et al*. en preens). In 2002 and 2003, an estimated 193 and 208 Japanese longliners, respectively, were operating in the Atlantic Ocean (ICCAT 2005). In the year 2003, a portion of the Japanese longline fleet's effort was concentrated between 0º and 20ºS, in the SWA (ICCAT).

## China

The Chinese fleet has focused its effort in the Atlantic Ocean primarily on big eye (*Thunnus obesus*), unloading 63 tons in 1992 and 7347 tons in 1999 (Hazin *et al*. in press). Pelagic longlining is the only method of tunid fishing used by the Chinese fleet in the Atlantic Ocean. The total number of longliners operating in the Atlantic rose to 38 in 2003, with a total catch of 10,048 tons of tunids and related species, which was greater than the 2002 catch (ICCAT 2005).

## Chinese Taipei*

This fleet's effort has been focused on albacore (*Thunnus alalunga*) throughout the entire Atlantic ocean since the early 1960s (Hazin *et al*. in press, ICCAT 2005). This species has traditionally been the fleet's priority, with a total of 17,377 tons unloaded in 1999 (Hazin *et al*. in press). Nevertheless, in recent years, the fleet has also directed its effort at big eye tuna (*Thunnus obesus*). The fishing effort reached 205 fishing vessels in 1999 (Hazin *et al*. in press). Chinese Taipei has declared that it carries out research and conservation activities directed at the sea turtles captured incidentally by its longliners. The Wildlife Conservation Law in Chinese Taipei has classified five species of sea turtles as endangered: *C. mydas*, *C. caretta*, *E. imbricata*, *L. olivacea* y *D. coriacea*. According to official sources, fishermen are currently being issued field guides for easy identification, books describing the biology and life cycle of turtles as well as dehookers and line cutters for removing hooks and lines from incidentally captured sea turtles. Onboard observers have been recording the incidental capture of sea turtles, identifying species and measuring the animals since the year 2000. This information will be used to create a database of bycatch information for those species (ICCAT 2000). Nevertheless, that information is not yet available.

**Pelagic longlining, which is widely distributed throughout the region, is one of the fishing methods that should be most closely observed, due to the fact that it leads to a high rate of bycatch and accounts for a significant portion of the fishing effort.**

## Korea

The tunid fishery continues to be the most important component of Korea's fishing effort in distant waters. Most Korean longlining takes place in the Pacific and Indian Oceans, and the fishery of tunids and related species in the Atlantic has been declining gradually year after year since the mid 1980's. During 1990, the average number of Korean tuna boats operating in the Atlantic was less than 10 per year, with an annual catch of 1700 tons (ICCAT 2005). The effort of these fleets in the Atlantic Ocean has been on the decline since 1977 and is currently concentrated between 20ºN and 20ºS, and directed especially at big eye tuna (*Thunnus obesus*) with a total catch of 124 tons in 1999 (Hazin *et al*. in press). In 2003, the Korean fishing effort was concentrated in the

* The denomination of this fleet follows the ICCAT documentation.

Eastern South Atlantic, where 402 tons of tunids and related species were caught (ICCAT 2005). Korea does not currently have a program of onboard scientific observers in place in the Atlantic Ocean (ICCAT 2005).

## Spain

Spanish pelagic surface longliners initiated their fishing activities in the early 1970s, mainly focusing on swordfish (*Xiphias gladius*). A total of 4393 tons of swordfish were caught in the South Atlantic during 1988, increasing to a total catch of 11290 tons in 1995 (Hazin *et al*. in press). The Spanish fleet's fishing strategy has changed significantly over the past few years, and it continues to shift periodically depending on price fluctuations and the abundance of fish on the market. Fishing vessels have been alternating between swordfish and blue shark (*Prionace glauca*) as their target species (Hazin *et al*. in press). Although there are some onboard observers, information regarding sea turtle bycatch is unavailable.

## Other fisheries, with which sea turtle interactions have been reported in the SWA

While reviewing the literature, we found that in addition to trawling, gillnetting, and pelagic surface longlining, there are other fishing methods and gear (corrals, fishing weirs, bottom longlines, hook and line sportfishing, beach seines and shrimp traps) that lead to interactions with sea turtles in the SWA (Domingo *et al.* 2005). What follows is a list of descriptions and information about the gear and methods for which information exists.

## Traps and fyke nets

Traps and fyke nets are fishing gear used mainly to catch mollusks, lobster, crabs and benthic fish. Interaction with sea turtles has been observed while using these types of fishing gear, however, the scarcity of information does not allow for a an analysis of the impact level of these methods. Nevertheless, the existing records indicate that sea turtles do

**There are large areas of the SWA, including coastal zones, for which no information is available.**

indeed interact with this type of fishing gear to some degree. Sánchez *et al.* (in press) reported the bycatch of three *D. coriacea*, which were caught on the main line of a boat that was conducting exploratory conch fishing using fyke nets in the Uruguayan EEZ.

## Fishing Weirs

Fishing weirs (fences) are a fairly widespread type of fishing gear on the northern coast of Sao Paolo, Brazil. The net is composed of two structures, the first of which (called a "caminho" in Portuguese) is fixed to the shore on one end and attached to the second structure (or "rodo") on the other end. The "caminho" is held by buoys on the surface and secured to the bottom with rocks or weights that hold it in position, covering the entire water column. Fish don't get tangled up, but rather swim freely inside the net (Tamar 2000) between 1991 and 1998 in Ubatuba, 2515 *C. mydas* were caught in fishing weirs (Gallo *et al.* 2000) and 72 *C. mydas* were caught between September of 2003 and March of 2004 on the island of Santa Catarina (Santos & Soto 2004).

**Table 2.** Summary of the information regarding fisheries operating in each country. I: whether or not the fishery exists. II: whether there have been reports of interaction with sea turtles. III: impact level (1=high, 2=medium, 3=low). This information is based on the bibliographic analysis and the data used by the authors.

| Fishery | Argentina | | | Uruguay | | | Brazil | | |
|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | I | II | III | I | II | III |
| Outrigger trawling | yes | no | | yes | yes | 3 | yes | yes | 3 |
| Bottom trawling | yes | yes | 3 | yes | yes | 3 | yes | yes | 3 |
| Bottom pair trawling | yes | yes | 2 | yes | yes | 1 | yes | yes | 2 |
| Corrals | no | | | no | | | yes | yes | 3 |
| Weirs | no | | | no | | | yes | yes | 3 |
| Bottom longlining | yes | no | | yes | yes | 3 | yes | no | |
| Longlining for mahi-mahi (*Coriphaena hippurus*) | no | | | no | | | yes | yes | 2 |
| Pelagic longlining | no | | | yes | yes | 1 | yes | yes | 1 |
| Hook and line sportfishing | yes | no | | yes | yes | 3 | yes | no | |
| Bottom otter board trawling | yes | yes | 3 | yes | yes | 3 | yes | yes | 2 |
| Bottom gillnetting | yes | yes | 2 | yes | yes | 2 | yes | yes | 2 |
| Driftnetting | no | | | no | | | yes | yes | 1 |
| Shrimp trapping | no | | | yes | no | | yes | yes | 3 |

### Corrals

The fish corral, or "curral de pesca" in Portuguese, is an unselective type of fishing gear that is quite common in the communities along the west coast of Ceará, Brazil. Corrals are built using wood and wire mesh and are placed in open water in order to catch live fish. (TAMAR 2000) Barata *et al.* (2004) indicated that four *D. coriacea* were caught in Ceará using this type of gear between 1992 and 2001, while Lima *et al.* (2004) observed that 71 *C. mydas* were caught in Almofala, using the same gear, between January and June of 2004.

## Conclusions

Although there have been advances over the past few years with regards to the existing knowledge about the interaction of sea turtles with fisheries in the SWA, there is still a great deal of work to be done in order to minimize the effects of these interactions. Further research must be done on many subjects, including the biology and ecology of sea turtle species as well as the effective application of mitigation methods.

The diversity of fisheries operating in the area as well as the different fleets, calls for a regional and international effort to collect information on bycatch. The increased fishing pressure exerted in the area has not been accompanied by an increase in the information regarding the incidental capture of species that have no economic value.

Members of administrative agencies are starting to understand the importance of ecosystem based analysis. This is the direction which research and conservation efforts should continue to follow.

In light of the information that has been gathered on the subject, pelagic longlining is one of the fisheries which require increased attention, due to its high levels of bycatch, as well as its significant effort and broad distribution throughout the region. ICCAT has already begun addressing the issue, by including sea turtles in the list of species for which data are collected. The Bycatch Subcommittee has been urging researchers to develop studies and present papers on sea turtles. Coastal trawling and gillnetting should also be considered as critical fisheries, because they also lead to a high rate of bycatch. It is important to consider that these three fishing methods are by far the most widespread and account for the highest fishing effort.

Driftnets deserve special consideration because, although they are used exclusively in Brazil, their high rate of bycatch turns them into a serious threat to sea turtles, in particular to *D. coriacea*.

## Strandings

Several papers on turtle strandings were analyzed in conjunction with those papers directly related to interactions between turtles and fisheries, since many of these papers also contain references to the effects of fishing. Studies on sea turtle strandings have been conducted along the coasts of Argentina, Uruguay and Brazil. Many of these indicate that stranded turtles may have been caught using different types of fishing gear.

In Argentina, information about strandings was analyzed between 1945 and 2003 (Albareda *et al.* 2003, Prosdocimi *et al.* 2004). The existence of 95 reports of stranded turtles, of which 47 were *Dermochelys coriacea*, 26 *Chelonia mydas* and 22 *Caretta caretta,* was verified. Rodriguez-Heredia *et al*. (2004) also mention incidents of strandings involving those three species in the Bay of Samborombon. Albareda & Bordino (2003) consider coastal surveying an important source of information for detecting mortality associated with local fisheries.

In Uruguay, Frazier (1984) found stranded individuals of all three species. More recently, between July 2001 and June 2003, 163 turtles were found stranded along the entire Uruguayan coast. The great majority of these individuals were juvenile members of *C. mydas* (60%), followed by adults and sub-adults of *D. coriacea* (9%) (López-Mendilaharsu *et al.* 2003). Mortality associated with fishing activities was only determined for 12 turtles (7.4%). Spring and summer were the seasons during which most of the *C. mydas* strandings took place, with the greatest number occurring in January. The greatest number of *C. caretta* was observed in summer and autumn, mostly in August. The greatest number of *D. coriacea* were found in autumn.

On the coast of Rio Grande do Sul, in southern Brazil, several different researchers have studied sea turtle strandings since 1991. Based on the findings of Monteiro (2004) and data provided by Nakashima *et al*. (2004), Pinedo *et al*. (1998) and Bugoni *et al.* (2001) a total of 1388 turtles, including 454 *C. mydas*, 671 *C. caretta*, 170 *D. coriacea*, 11 *L. olivacea*, 2 *E. imbricata* and 80 unidentified animals were found on different occasions and in different parts of the area. The sizes of the three most common species were similar to those of the turtles found in Uruguay. The *L. olivacea* are immature animals and adults.

Between Torres and Lagoa do Peixe, in the northern part of Rio Grande do Sul, Moreno *et al.* (2003) reported 266 stranded turtles between October 1991 and May 2003, of which 94 were *C. mydas*, 140 *C. caretta*, 28 *D. coriacea*, 2 *L. olivacea* and 2 *E. imbricata*. Bugoni *et al.* (2001) cites a mortality rate of 4.3% for stranded turtles, caused by fishing activities, while Monteiro (2004) reported a rate of only 3.4% for the 994 turtles that were analyzed. Monteiro (2004) confirmed that stranded *C. caretta* are significantly smaller than those captured by longliners in the waters of southern Brazil. On the northern coast of Bahia, 331 stranded turtles were reported between 2000 and 2001. Most of those strandings were attributed to bottom gillnetting for lobster (Jardeweski *et al.* 2003). In Sergipe, in northeastern Brazil, stranded sea turtles were studied between 1996 - 2000 and 237 turtle deaths were recorded, of which 57.1% were *L. olivacea*, 36.4% *C. mydas*, 3.9% *C. caretta* and 2.6% *E. imbricata* (Silva *et al.* 2002). The authors have mentioned that shrimp trawling in coastal areas leads to a high rate of mortality, mainly of *L. olivacea,* near its main nesting areas in the SWA.

In Paraíba, in northeastern Brazil, approximately 3 km of beach were monitored between March and August of 2003 and 79 *C. mydas*, one *L. olivacea* and one *E. imbricata* were found. Marks made by fishing gear were observed on the dead turtles (Mascarenhas *et al.* 2003, 2005). In Almofala and Praia do Farol, Ceará, 11 stranded *C. mydas* and two *E. imbricata* were recorded in the year 2000. Eight of the turtles were missing some of their flippers or their head, which suggests that they were mutilated by fishermen in order to remove them from gillnets (Lima 2001).

# Institutions: Current lines of investigation and conservation measures regarding fisheries

## Argentina

### Regional Program of Investigation and Conservation of Marine Turtles in Argentina PRICTMA

The creation of the Regional Program of Investigation and Conservation of Marine Turtles in Argentina (PRICTMA) during late 2002, consolidated the regional integration of the different institutions that conduct research, outreach and conservation of sea turtles in Argentina. As a result of that integration, a diagnostic report was compiled, which facilitated the evaluation of the current situation of marine turtles and the information existing about them in Argentina. This report served as a basis for establishing PRICTMA's future course of action.

PRICTMA facilitates the ample and permanent monitoring of the rivers and coastal area of the province of Buenos Areas. It also helps extend the sea turtle conservation effort to the provinces of Rio Negro and Chubut.

The program is currently comprised of six institutions, which actively participate in its various research and education activities. Those institutions are the following: The Buenos Aires Aquarium, The Peyu Project-Sea Turtles of Argentina, the Marine World Foundation, Aquamarina-CECIM, the Mar del Plata Aquarium Foundation, the Provincial Multiple Use Natural Reserve of Bahia Blanca, Bahia Falsa and Bahia Verde and the Natural Resource Directorate of the Ministry of Agricultural Affairs and Production.

the goal of PRICTMA is to establish a consensus in terms of local objectives and strategies for optimizing and strengthening the technical and logistical capacities of each one of its members in order to facilitate significant advances in the research and conservation of sea turtles in Argentina. PRICTMA also serves to help balance the asymmetrical technical methods and logistics that are already in place, cooperating with and assisting the coastal areas with the greatest necessity, and thus homogenizing regional efforts.

In May of 2004, PRICTMA's first joint scientific research project was initiated, with the support of the Field Veterinary Program - Wildlife Conservation Society (WCS). That project, which concluded in late 2005, consisted of monitoring the coastal fisheries of the northern portion of the province of Buenos Aires and their interaction with sea turtles. It also sought to address certain biological and sanitary issues with regards to the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*). This project was conducted in conjunction with the La Plata dolphin (*Pontoporia blainvillei*) bycatch reduction project, which was carried out by Aquamarina-CECIM-PRICTMA with the support of the Wildlife Trust and the Fundación Vida Silvestre Argentina.

At the same time, in the southern part of the province of Buenos Aires, inside the Multiple Use Natural Reserve of Bahia Blanca, Bahia Falsa and Bahia Verde-PRICTMA an outreach campaign directed at that region's artisanal fishing community has been in place since 2002. The main objective of that campaign is to generate knowledge and awareness of the various problems faced by the different species of local marine wildlife, with an emphasis on sea turtle conservation. This activity has generated a positive reaction from the fishing community since its inception, which has allowed obtaining positive results in the first scientific investigation activities that have been carried out in this coastal sector of the province of Buenos Aires.

Elsewhere, along the river sector of Rio de La Plata, in the communities of Berisso and Ensenada, the Peyu Project-PRICTMA, began monitoring an artisanal fishery operating in the waters of that river in 2004. Interactions between green turtles (*Chelonia mydas*) and local fishermen have been recorded. That fishery along with one operating out of the city of Gualeguaychu (in the Province of Entre Rios) on the banks of the Uruguay River, are the only two fisheries operating exclusively in river waters, with which sea turtle interaction has been recorded.

The Regional Program has received the continuous support of the Fundación Vida Silvestre Argentina, which has seconded all of its activities since its inception, in particular outreach campaigns, environmental education activities and in providing technical advice with regards to international conventions.

The priorities that PRICTMA has established for 2005-2006 are a product of the results and advances achieved during nearly three years of work. The general goals are the following:

- To increase monitoring and research efforts in the southern coastal sector of the provinces of Buenos Aires, Rio Negro and Chubut, in an effort to establish the southern distribution limit for turtles in the SWA. Over the course of 2005, various educational training courses, regarding the biology and medical treatment of sea turtles, were conducted in conjunction with the respective local wildlife agencies of Rio Negro and Chubut. Those training courses were directed at wildlife rangers, park rangers, local researchers and local members of the Argentine Naval Prefecture, thus educating individuals and creating ties between local institutions in an effort to incorporate them into PRICTMA.

- Quantification of the bycatch of sea turtles by the fisheries being monitored in the northern portion of the Province of Buenos Aires (coastal bottom trawlers and artisanal gillnetters) and analysis of the spatial and temporal distribution of those animals.

- Increased monitoring of incidental sea turtle mortality, through surveys to be conducted at fisheries in the central and southern sectors of the provinces of Buenos Aires and Rio Negro. This monitoring is meant to help explore new zones in an effort to detect other fisheries that interact with sea turtles.

- To obtain the initial results of genetic analyses of samples obtained from victims of bycatch and stranded specimens along the entire coast of Argentina, in order to determine the impact of inappropriate resource exploitation on reproductive populations.

- To continue to study feeding habits by analyzing the stomach contents of loggerhead turtles (*Caretta caretta*), green turtles (*Chelonia mydas*) and leatherback turtles (*Dermochelys coriacea*), using specimens who have died as a result of interaction with fishermen or stranded animals.

- To continue to conduct sanitary studies and epidemiological monitoring in order to determine the health and wellbeing of the regional sea turtle population. Systematic necropsies and histopathological studies, along with biomedical research conducted during rehabilitation activities are the main tools to be used for accomplishing this objective.

- To continue and broaden the sea turtle tagging plan, by conducting training regarding tagging techniques and distributing tags along the entire Argentinean coast line and coastal river system.

- To focus on leatherback turtle monitoring, by coordinating four interdisciplinary teams (made up of veterinarians and biologists) to be distributed along the length of the coastal area and river zone of Buenos Aires. These groups will try and accurately diagnose mortality due to natural causes as well as incidental fishing and help better utilize the available biological information.

- Continued development of the educational and outreach programs directed at coastal communities and artisanal fishermen, as part of a general process that will facilitate the implementation of conservation measures in the future. These programs involve training courses, outreach talks, different activities directed at educational establishments as well as the distribution of posters and didactic flyers.

## Uruguay

### Karumbé

Karumbé: Preserving the Sea Turtles of Uruguay is a conservation project that conducts research, education and outreach at all levels and seeks to protect sea turtles and their habitats in Uruguay as well as the waters of the SWA. The project is organized around different areas of action with specific functions. The portions of the program that are related to turtle interaction with fisheries are PROMACODA and PROARTE.

The Onboard Tagging and Data Collection Program (PROMACODA) and the Artisanal Fishery Monitoring Program (PROARTE) are directed at monitoring industrial and artisanal coastal bottom trawlers in the effort to quantify and analyze the spatial and temporal distribution and incidence of sea turtle bycatch produced by both these fisheries. Those programs also seek to increase fishermen's awareness of the critical state of sea turtle populations through long term educational programs.

- **Genetics:** the goal is determine which sea turtle populations are being affected by fishing and also to determine the natal beaches of the turtles that inhabit Uruguayan waters as well as SWA waters.

- **Education and Community Development:** the objective is to increase the awareness of fishermen and their families as well as that of the general population, in order to achieve the care and protection of sea turtles. Improved community development through sustainable and innovative economic alternatives is also being sought.

- **Strandings Network:** the network exists in order to quantify the number of stranded turtles and collect samples from those specimens in order to conduct genetic analyses as well as studies aimed at determining feeding habits and learning more about epibionts.

- **Veterinary and Rehabilitation Program:** this is part of an effort to treat and rehabilitate turtles that are sick and wounded as a result of interaction with fishing gear.

- **Regional Integration:** the goal is to achieve a fluid and constant dialogue with sea turtle conservation programs throughout the region, while simultaneously promoting joint projects, drafting of scientific articles and organization ofconferences, with the different institutions throughout the SWA region.

### National Directorate of Aquatic Resources (DI.NA.R.A) National Program of Onboard Observers for the Uruguayan Tuna Fleet (PNOFA)

The National Program of On Board Observers seeks, among other things, to record and analyze bycatch. This program has been in place and operating consistently since 1998. Its members have been conducting tagging and biological sampling activities on the sea turtles that are intercepted, in addition to monitoring the Uruguayan pelagic surface longline fleet.

## Brazil

### Environmental Monitoring and Education Center (NEMA) "Sea Turtles of the Coast of Rio Grande do Sul-NEMA" Project

The Environmental Monitoring and Education Center (NEMA) is a non-governmental organization located at Praia do Cassino, Rio Grande do Sul (RS). It has been conducting projects aimed at environmental conservation since 1985.

Since 1994 the "Sea Mammals of the Southern Coast Project-NEMA" has been conducting systematic monitoring outings on the beaches of the RS coastline, with the goal of recording instances of stranded sea mammals. During these outings, a significant number of stranded sea turtles have been observed. It was for that reason that the "Sea Turtles of the Coast of Rio Grande Do Sul" Project was created in 2003, with the support of the TAMAR/IBAMA Project.

The Sea Turtles Project has the goal of decreasing sea turtle mortality rates, in addition to promoting responsible fishing and community development, through research, environmental and community development activities. The project's main activities and elements consist of the following:

- **Monitoring the beach:** monthly outings are conducted on the coast of RS, form Arroyo Chuy to the Barra da Lagoa do Peixe, covering a total of 360 km of beaches. During these outings, sea turtle species are recorded, along with strandings positions, biometry and the degree of decomposition. Tissue samples are also taken for genetic analyses.

- **Monitoring sea turtle bycatch as a result of fishing activities:** bycatch is monitored both through the use of onboard record sheets which are completed by fishing boat captains and through a program of onboard observers.

  - Onboard record sheets: Most boat captains who are involved in industrial fishing in addition to those involved in artisanal fishing in the interior of the Lagoa dos Patos and the adjacent coastal region, complete onboard record sheets. These sheets contain information regarding the fishing area, catch, depths, gear characteristics (i.e. net length), duration of fishing activities and, should turtle bycatch occur, the species, number of animals caught and the status of those individuals. Visits are conducted weekly or monthly, depending on the type of fishing, in order to collect record sheets and distribute new ones.

  - Onboard observers: In 2004, The Sea Turtle Project group, conducted an onboard observer course in conjunction with the TAMAR project, in which several students participated. These students work on board industrial surface gillnetting, bottom gillnetting, driftnetting and pelagic longlining vessels in addition to artisanal fishing boats. Observation takes place depending on the availability of boats and observers and according to the different fishing seasons. While aboard fishing vessels, observers collect biotic and environmental data as well as tagging specimens and taking samples.

- Environmental education activities: these events take place at schools in the fishing communities of Rio Grande, São José do Norte and Passo de Torres. They consist of lectures on the biology and ecology of sea turtles, the main threats faced by these animals and the actions taken by the project. They also include artistic activities such as painting, drawing and ceramics and psychophysical activities such as creative visualization, breathing and cooperative games.

- Community development activities: In 2004, the Sea Turtles-NEMA Project invited women from the fishing community to participate in educational and handicrafts courses. After the courses, the Grupo de Artesanas de la Barra (La Barra Artisans Group) was formed, which is currently made up of eight women. The group produces handicrafts with turtle themes. These items are displayed and sold at local fairs and street markets.

- Interviews with fishermen: during interviews, information regarding bycatch as well as the fishermen's experience, knowledge and views about sea turtles, are collected.

- Rehabilitation: the rehabilitation of sea turtles is conducted through an agreement between the Sea Turtles-NEMA Project and the Marine Animal Recovery Center (CRAM), which is part of the Oceanographic Museum (FURG). Stranded turtles or individuals that have been caught by fishermen in estuaries are rehabilitated while biological information is collected.

**The SWA network, which was established in 2003, is a valuable instrument that has allowed the region's researchers and institutions to exchange and share their experiences.**

- **Outreach:** Informative and educational materials, such as pamphlets and calendars for fishermen as well as notebooks for children, have been produced.

- **Evaluation and use of mitigation measures during fishing:** dehookers were distributed to pelagic longline boat captains who work in Rio Grande. A feasibility study was conducted for adapting TED to local trawl fishing, which led to the production of a document containing a theoretical model for a TED system adapted to the local trawling realities of Rio Grande do Sul.

### The Itajaí Valley Oceanographic Museum (MOVI)

The Itajaí Valley Oceanographic Museum (MOVI) is an institution with ties to the University of the Itajaí Valley (UNIVALI). It was founded in August of 1993 and its efforts are focused on compiling a museum collection. It is located in Balneário Camboriú and has been an institutional member of the International Council of Museums (ICOM) since 1994.

MOVI's sea turtle section contains a large collection of bones, shells, embryos, newborns and tissue samples form the five species that are present in Brazil. These items are obtained mainly as a result of beach monitoring activities, and also include materials sent by other institutions and collected by observers and fishermen.

In addition to collection related activities, the MOVI conducts observation activities onboard fleets of longliners, gillnetters, trawlers and other fishing gear. As part of their agreement with the TAMAR Project, observers obtain bycatch data. Tagging activities, biometric data collection and the collection of biotic and abiotic data related to bycatch, are carried out as well. Information and materials are also collected from the fishing sector. Efforts are focused on obtaining data regarding the bycatch of *Caretta caretta* and *Dermochelys coriacea* by the industrial pelagic longline fleet and *Chelonia mydas* by artisanal gillnetters on the coast of Santa Catarina.

**All of the institutions mentioned in this report have included the collection of information regarding sea turtle interaction with fisheries among their main objectives.**

### **TAMAR/IBAMA.** Program for Evaluation of the Interaction between Sea Turtles and Fishermen (PROGRAMA TAMAR-PESCA)

The Tamar Project is a program run by the Brazilian government which has been conducting sea turtle research and conservation activities since the 80s. It is active in areas where sea turtle bycatch occurs, inside feeding and development areas since the 90s. In the year 2001 the Tamar-Pesca progam, which involves a series of activities directed at evaluating, monitoring and reducing bycatch, was created. The main activities that take place are:

- **Monitoring sea turtle bycatch.** This is done through an onboard observer program and the use of onboard record sheets.

- **Tagging and biometry.** Turtles caught by monitored boats are tagged and biometric data are collected

- **Population genetics.** Tissue samples are taken from turtles that are caught in order to conduct DNA analyses.

- **Blood analysis.** Blood serum is extracted for the analysis of various parameters.

- **Circle hooks.** Experiments with 18/0 circle hooks in order determine their effectiveness in reducing post-capture mortality.

- **Dehookers.** These tools are being used to remove hooks more effectively.

- **Line cutters.** These tools are being used to release turtles that are not brought aboard.

- **Puçás (*dip nets*).** This sort of net is used to bring turtles aboard so that they are not held by the secondary line.

- **Modified bait (odor).** Experiments are conducted in tanks with nets in order to help identify turtle repellent odors.

### **GEMARS:** The Rio Grande do Sul Aquatic Mammal Study Group (GEMARS).

The Rio Grande do Sul Aquatic Mammal Study Group (GEMARS) is a nonprofit organization, founded in 1991, which conducts scientific research and environmental education activities, related to the conservation of species of aquatic mammals and sea turtles, and their natural habitats.

Since 1992, GEMARS has been carrying out projects in conjunction with the Center for Coastal, Limnological and Marine Studies (CECLIMAR) of the Federal University of Rio Grande do Sul (UFRGS), in an effort to document the species of mammals and sea turtles on the coast of Rio Grande do Sul, and obtain information regarding the biology of those species and the main conservation problems.

With the goal of preserving these species as well as the entire marine ecosystem, GEMARS/CECLIMAR has sought to work together with fishermen and residents of coastal communities.

The monitoring of stranded sea turtles is one of the activities that is conducted. These institutions also seek to establish and maintain contact with the fishermen of the northern coast of Rio Grande do Sul in order to jointly obtain data .

## Conclusions

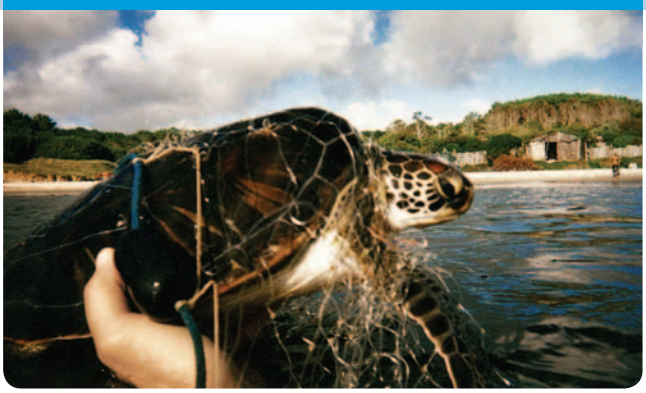
Although there are several organizations working toward sea turtle conservation in the area, most of them have only begun working on bycatch issues over the last decade. This is reflected in the quantity and scope of the available publications, as well as the advance in activities aimed at mitigating the problem.

All the institutions mentioned in this report have included obtaining information regarding sea turtle interaction with fisheries among their main goals. In some cases, the institutions are conducting working programs aimed at monitoring fisheries and testing mitigation measures. Many of these institutions have managed to establish working relationships with fishermen, ship owners and administrators. Nevertheless, access to funding is a limiting factor in terms of testing and/or developing mitigation measures. The capacity that the institutions and researchers in the region have demonstrated until now, allows asserting that they are in a position to continue advancing to increase knowledge and testing mitigation measures.

The SWA network has been a very valuable instrument since its inception in 2003, which has allowed researchers and institutions to exchange their experiences and provided support for the development of joint activities. In this manner, it has helped strengthen marine turtle conservation efforts.

**Note:** Information regarding the different institutions that work with sea turtles in the SWA was obtained from the following sources:


- Proceedings - First Southwestern Atlantic Marine Turtle Research and Conservation Conference. October 1- 3, 2003. Montevideo. Uruguay.
- Proceedings- Second Southwestern Atlantic Marine Turtle Research and Conservation Conference and Workbooks. September 30th- October 2nd, 2004. San Clemente del Tuyu Bs. As., Argentina.
- Domingo A., Bugoni L. & Prosdocimi L., 2005. Situational Diagnostic Evaluation: Marine Turtles and their Interaction with Fisheries in the Southwestern Atlantic. Marine Turtle Specialist Group for Research and Conservation in the Southwestern Atlantic. Montevideo. Uruguay, p. 22
- TAMAR-IBAMA Project. 2005. Marine Turtles in Brazil: State of the Art. TAMAR-IBAMA.



# Strengths and weaknesses of conservation efforts, research and management policies

Brazil, Uruguay and Argentina have begun an integrated project through the Marine Turtle Specialist Group of the Southwestern Atlantic (SWA). This group has conducted joint activities, forming an effective regional communication network. The problems and solutions regarding the conservation of migratory marine species, turtles in particular, are inherent to all three countries. Although differences exist between those nations in terms of the qualitative and quantitative presence of sea turtles in each of their respective jurisdictional waters, all three of them are participants in some phase of the life cycle of most sea turtle species. This section outlines some of the difficulties that the group faces inside the region as well as some aspects that reflect the integration effort's enormous potential for advancing sea turtle conservation.

## Weaknesses

- Insufficient economic resources for the development of adequate educational programs and outreach campaigns regarding the issue of sea turtle bycatch.
- Limited resources for maintaining continuous research and conservation activities, which hampers the feasibility and development of medium and long term activities, such as the analysis of mitigation measures and monitoring programs.
- Difficulty conducting evaluations of bycatch and post-capture mortality mitigation measures, due to a lack of information and insufficient funding.
- Limited information regarding the fishing fleets of the non-coastal nations of the SWA, which are operating in the region.
- Insufficient management policies in terms of regional and local implementation of marine turtle conservation measures
- Gaps in fisheries statistics.
- A lack of participation and/or implementation of conventions and international treaties (IAC, CMS, etc.) by all of the countries in the SWA region.

## Strengths

- The existence of a strong integrated regional effort, joint sample collection activities, analysis of data and publications. Creation of the Marine Turtle Specialist Group of the Southwestern Atlantic Ocean (SWA) and the organization of SWA Conferences I (Montevideo-Uruguay, 2003), II (San Clemente del Tuyú- Argentina, 2004) and III (Cassino, RS-Brazil, 2005).
- Multidisciplinary working groups in each nation and the participation of technicians from different countries in local projects, as part of the exchange program.
- Good relationships with fishermen and coastal communities, the main actors involved in this issue, who are collaborating on research and conservation projects.
- Research activities conducted with the help of scientists and organizations from outside the region, which helps SWA researchers to stay up to date.

**The primary weakness is the lack of economic resources, which compromises the feasibility of activities as well as preventing them from being carried out in the medium and long term.**

# Recommendations

## **Research and Conservation Priorities.** Requirements for carrying them out.

| Activity | Instruments | Needs | Period |
|---|---|---|---|
| Maintaining and strengthening the SWA network | Permanently updating the web page<br>Conducting biannual meetings of the SWA's institutions | Hiring an executive secretary<br>Partial funding for the SWA headquarters and equipment.<br>Funding for periodic meetings (30 people, two specialists from outside the region).<br>Funding for publishing reviews. | Permanent Activity |
| Monitoring the region's pelagic longliners | Observers onboard longline vessels.<br>Existing observer programs. | Training Observers.<br>Per diems for observers.<br>Tagging and collection materials.<br>Technical personnel for processing information. | Permanent Activity |
| Monitoring driftnetters | Observers onboard vessels.<br>Existing observer programs. | Training Observers.<br>Per diems for observers.<br>Collection materials .<br>Personnel for processing information. | Short and medium term |
| Monitoring the region's trawlers | Observers onboard trawlers<br>Implementing existing observer programs. | Training Observers.<br>Per diems for observers.<br>Tagging and collection materials.<br>Personnel for processing information. | Permanent Activity |

| Activity | Instruments | Needs | Period |
|---|---|---|---|
| Permanent education for fishing boat crews and coastal communities | Courses and general outreach regarding the life cycle and conservation of sea turtles. | Technical teaching personnel .<br>Teaching and informational materials. | Permanent<br>Activity |
| Data regarding bycatch rates and interaction with fisheries | Information regarding effort and bycatch, spatial, temporal and environmental framework, acquired through data collection programs. | Technical personnel.<br>Directed projects. | Short and medium term |
| Publication of the information generated through research | Presentation of scientific articles and books | Funding for technical personnel and publications | Short and medium term |
| Testing mitigation measures | Designing a sampling plan in order to test circle hooks in longline fisheries.<br>Designing a leatherback turtle release system for trawlers.<br>Designing a TED adapted to coastal trawling directed at fish. | Funding for materials, observers and technical personnel. | Short and medium term |
| Monitoring strandings | Existing programs for monitoring strandings.<br>Programs for monitoring strandings in new areas. | Vehicle and maintenance costs.<br>Technical personnel.<br>Collection materials. | Permanent<br>Activity<br>/ Short term |
| Genetic analysis of populations | Collecting material through onboard observer programs and from stranded specimens. | Funding for sequencing.<br>Personnel for analyzing samples.<br>Collection and analysis materials. | Short and medium term |
| Creating National and Regional Action Plans as well as directives and strategies for the conservation of sea turtles | Participation and consensus among the different actors involved in this issue.<br>Orchestration. | Workshops for preparing the plans.<br>Meeting with turtle experts that operate in the region.<br>Publication. | Short term |

| Activity | Instruments | Needs | Period |
|---|---|---|---|
| Orchestrating National and Regional Action Plans | Legislation as well as monitoring and enforcement activities. Application of mitigation measures | Inspection and follow-up on progress. | Short term |
| Strengthening the technical capacity of human resources | Training | Financial aid scholarships for national and international courses. | Permanent |
| Determining the spatial-temporal distribution of sea turtles. | Strengthening tagging programs. Implementation of new monitoring programs that use satellite telemetry. | Tagging materials<br>Logistical costs<br>Satellite transmitters<br>Funds for paying ARGOS | Short and medium term |

**Good relationships with fishermen and coastal communities as well as strong regional integration, are factors that contribute favorably to the conservation of sea turtles in the SWA.**

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# Anex

## Anex I: Bibliographic compilation


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## Anex II: ICCAT Bycatch Table*

| Total number of species captured with the different gears | Count Group | Pelagic Longline | Gillnet | Purse-Seine | Live bait | Harpoon | Trap | Others |
|---|---|---|---|---|---|---|---|---|
| 214 | All Groups | 149<br>69.6% | 110<br>51.4% | 78<br>36.4% | 12<br>5.6% | 33<br>15.4% | 20<br>9.3% | 43<br>20.1% |
| 12 | Rays and related species | 10<br>83.3% | 6<br>50.0% | 6<br>50.0% | 0<br>0.0% | 2<br>16.7% | 0<br>0.0% | 1<br>8.3% |
| 46 | Coastal Sharks | 45<br>97.8% | 19<br>41.3% | 6<br>13.0% | 1<br>2.2% | 7<br>15.2% | 2<br>4.3% | 9<br>19.6% |
| 11 | Pelagic Sharks | 10<br>90.9% | 7<br>63.6% | 5<br>45.5% | 0<br>0.0% | 5<br>45.5% | 2<br>18.2% | 4<br>36.4% |
| 23 | Teleosts (ICCAT Species) | 23<br>100.0% | 18<br>78.3% | 16<br>69.6% | 9<br>39.1% | 6<br>26.1% | 7<br>30.4% | 11<br>47.8% |
| 82 | Teleosts (excluding Scombridae and billfishes) | 44<br>53.7% | 37<br>45.1% | 25<br>30.5% | 2<br>2.4% | 5<br>6.1% | 4<br>4.9% | 17<br>20.7% |
| 5 | Sea Turtles | 3<br>60.0% | 4<br>80.0% | 5<br>100.0% | 0<br>0.0% | 2<br>40.0% | 1<br>20.0% | 1<br>20.0% |
| 9 | Sea Birds | 8<br>88.9% | 2<br>22.2% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% | 0<br>0.0% |
| 26 | Marine Mammals | 6<br>23.1% | 17<br>65.4% | 15<br>57.7% | 0<br>0.0% | 6<br>23.1% | 4<br>15.4% | 0<br>0.0% |

***Taken from: www.iccat.es**

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